WASHING INSULATORS ON ENERGIZED EQUIPMENT

"Murray" – the modern STANDARD in maintenance ladders!

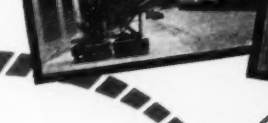
These maintenance units make overhead servicing *so* fast and easy that light output is kept at maximum.

The chief advantage of these Murray Crows'nests is that they make overhead, out-of-the-way lights, unit heaters and sprinkler heads, easily accessible, without disturbing men, machines or production schedules in the slightest.

All the many important plants which have taken on Murray Crows'nests, wonder how any plant ever got along without them. Fill in the coupon and mail—we'll propose a unit suiting your particular needs. Metropolitan Device Corporation, Brooklyn 16, N. Y.

Courtesy "Magazine of Light" General Electric Co.

Courtesy "Magazine of Light" General Electric Co.



Metropolitan Device Corp.
Brooklyn 16, N. Y.

Send data (without obligation) on Murray Crows'nest suitable for our requirements. Ladder must reach feet high, and extend feet side-ways. Aisle width is feet.

Name and Title_____

Company_____

Address_____

Murray crows'nest

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

April 15, 1944 — Vol. 121, No. 16

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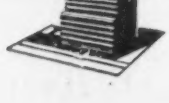


CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd Street, New York 18, N. Y.
Director of Circulation:

Please change my address on Electrical World

From .....

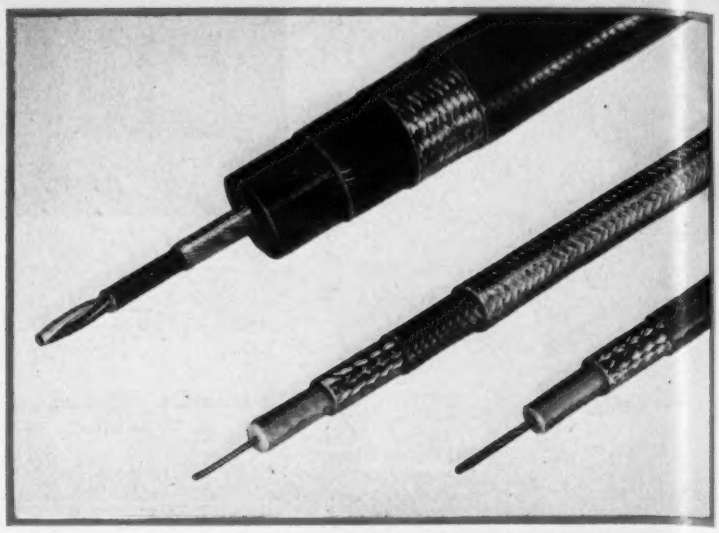
.....

To .....

.....

Signed .....

Typical Okonite Cables for electronic uses



THE APPLICATION OF SYNTHETIC INSULATIONS TO { Co-Axial Cables / High Voltage Cables / High Frequency Cables

The success of Okonite cables designed for today's electronic applications depends on work started over 10 years ago by Okonite Research engineers when they first commenced to use synthetics. Some types such as neoprene, koroseal, vinylite, and thiokol were soon found to have immediate applications, although there seemed to be no ready application for certain other types which had unusual, distinctive characteristics.

With the start of the war and the rapid progress made in extending the range of electronic equipment, cables were demanded having insulations with characteristics quite different from those used for ordinary power applications. The early research only then began to bear fruit and some of these new synthetics provided the answers to other war-time problems. The accompanying tabulation lists several of the synthetics available for use on cables and indicates their possibilities. Some already are used daily in our regular cable production. Others are only awaiting a need as yet unidentified. Perhaps you have a problem we can solve with these or other synthetics. Why not state your cable needs and let Okonite engineers make recommendations. We have both the equipment and the "know how" that can help provide a solution. Address, The Okonite Company, Passaic, N. J.

Typical Synthetic Materials with Promising Characteristics for Use on Electronic Wires and Cables

Name	Chemical Type	Use on Cable	Dielectric Constant	Power Factor	Dielectric Strength	Resistivity	Physical Properties	Oil Resistance	Resistance to Ozone and Sunlight
BUTYL RUBBER	Isobutylene-Diolefin Copolymer	Insulation	E	E	F	E	G	P	G
POLYBUTENE	Isobutylene Polymer	Insulation	E	E	F	E	F	P	E
POLYTHENE	Ethylene Polymer	Insulation	E	E	E	E	E	F	E
KOROSEAL	Plasticized Vinyl Chloride Polymer	Insulation or Jacket	F	F	G	F	G	E	E
VINYLITE	Plasticized Vinyl Chloride Vinyl Acetate Copolymer	Insulation or Jacket	F	F	G	F	G	E	E
BUNA S	Butadiene-Styrene Copolymer	Insulation or Jacket	G	G	G	G	G	F	F
BUNA N	Butadiene-Acrylonitrile Copolymer	Jacket	P	P	P	P	G	G	F
NEOPRENE	Chloroprene Polymer	Jacket	F	F	F	F	G	G	E
THIOKOL	Organic Polysulfides	Jacket	P	P	P	P	F	E	E

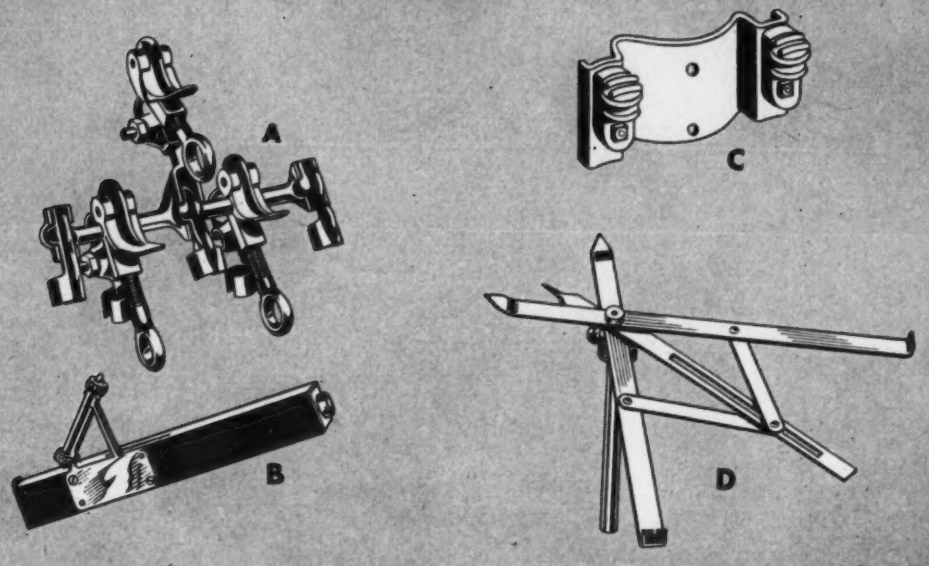
E—Excellent, G—Good, F—Fair, P—Poor. Physical properties include tensile strength, elongation, modulus, toughness and abrasion resistance.

OKONITE — INSULATED WIRES AND CABLES

3633

QUIZ:

What's the right line-job for each of these items?



Make GRAYBAR Your "One-call" Source for Pole-line Tools and Supplies

Whether the pole-line items you need are familiar or novel, standard or special, you'll find GRAYBAR well informed and well qualified as a supply source.

On the many different items used for pole-line work, GRAYBAR offers an unusually all-inclusive service. One call helps mobilize them all, from the top of the pole to the bottom of the hole.

When you order *via* GRAYBAR, you benefit from a unique combination of nationwide procurement experience and a real understanding of local needs. Product application suggestions are passed along to you by men familiar with your methods and standards. So far as war conditions permit, local stocks are maintained with *your* requirements in mind.

A GRAYBAR Man in your area is ready to make your supply problems his personal responsibility. Why not take advantage of his time-saving assistance? 3523

Here Are the ANSWERS (INVERT PAGE)

A — Lightweight grounding cluster (3-wire standard) for 4/0 str. copper or 3/0 ACSR maximum conductors.

B — Telehelght sighting device, for easy, yet accurate, determination of height of poles, trees, towers, etc.

C — Double neutral wire bracket for pole attachment.

D — Pole Bisector, used to simplify accurate placement of guy anchors.

GRAYBAR 75 YEARS OF Electrical Distribution

GraybaR

IN OVER 80 PRINCIPAL CITIES

Executive Offices: GRAYBAR BUILDING, NEW YORK 17, N. Y.

Largest to date

of those big high-speed induction motors engineered by

Here it is on the test block—the largest so far of the big 2-pole squirrel-cage induction motors for high speed drive, for which the Elliott shops have become well and favorably known. This one is direct-connected to an Elliott centrifugal blower. The motor is rated 2500 hp. at 3580 r.p.m. It is enclosed, self-ventilated with air cooler, lubricated from an integral pressure-lubricated system, and the electrical characteristics are 3 phase, 60 cycles, 2300 volts.

Under test the motor easily exceeded its guarantees on every point—starting torque and Kva, temperature rise, efficiency, power factor. In operation it is unusually quiet and smooth.

If you have a drive job that calls for this kind of motor, let us talk it over.

ELLIOTT COMPANY
Electric Power Department, **RIDGWAY, PA.**
DISTRICT OFFICES IN PRINCIPAL CITIES

A star has been added to the Army-Navy "E" flags flown by both the Jeannette and the Ridgway plants of Elliott Company.

ELLIOTT

L-746

CHECK the FACTS

1. By wiping under pressure, a new, clean contact is made with each operation.
2. Dirt-free, smooth operating hinge. Ring-type Hi-Pressure contact provides uniform blade pressure in all positions.
3. Uniform contact loading with individual contact clips, reinforced with pressure springs for each Hi-Pressure "button" contact.
4. Four bolt, type TC terminal clamp for 1200 and 2000 ampere rating. Lower ratings include two-bolt mounting pads for cable lugs or single clamps.

R&IE

DISCONNECTING SWITCH

Many operating schemes for group operated switches are shown in Bulletin 1310.

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

The Check List

CONDUCTOR SUPPORT CLAMPS AND FITTIN

DISCONNECTING SWITCH
INDOOR AND OUTDOOR

AIR BREAK SWITCH

INTERRUPTER SWITCH

CUTOUTS AND THERMO-RUPTERS

SWITCH OPERATIN MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSE

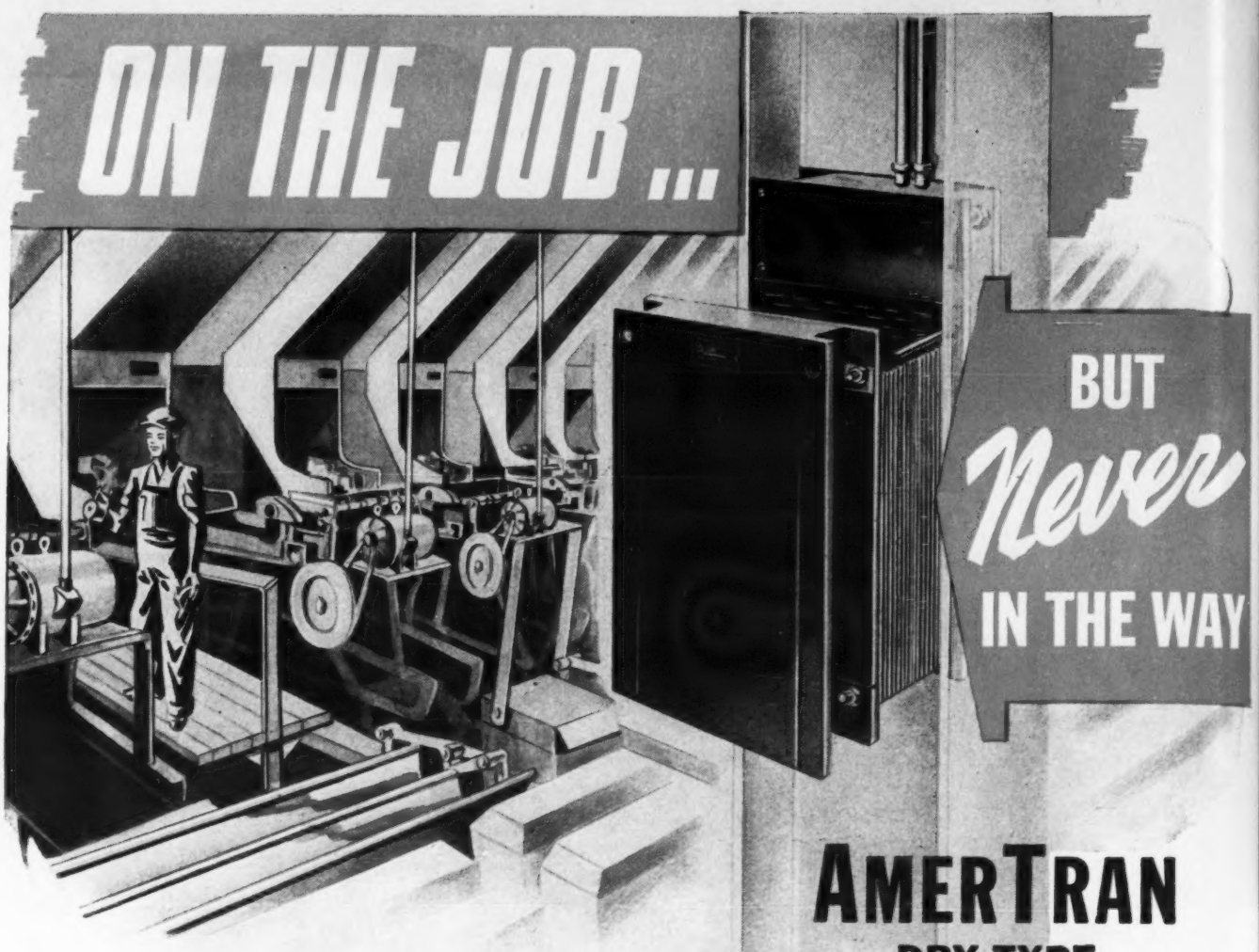
KIRK INTERLOCK SYSTEMS

AUTOMATIC SECTIONALIZING EQUIPMENT

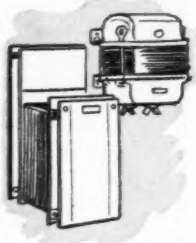
METAL CUBICLES

TESTING DEVICE

ON THE JOB ...



AMERTRAN
DRY-TYPE
TRANSFORMERS



Even in crowded load centers, AmerTran Dry Type Transformers are out of the way. Light, compact and smoothly contoured, they may be tucked into pillars or mounted overhead on I beams if necessary. They are made in a wide variety of ratings, and where ambient or operating conditions require, Class B insulation may be specified.

If you are looking for more than the usual advantages* from transformers at load centers, you have an additional reason for investigating AmerTran Dry Type Transformers. These units are used for insulating circuits, balancing loads, boosting line voltages, and in many other special applications. Complete information covering standard and special AmerTran Dry Type Transformers for indoor and outdoor location will be sent upon request.

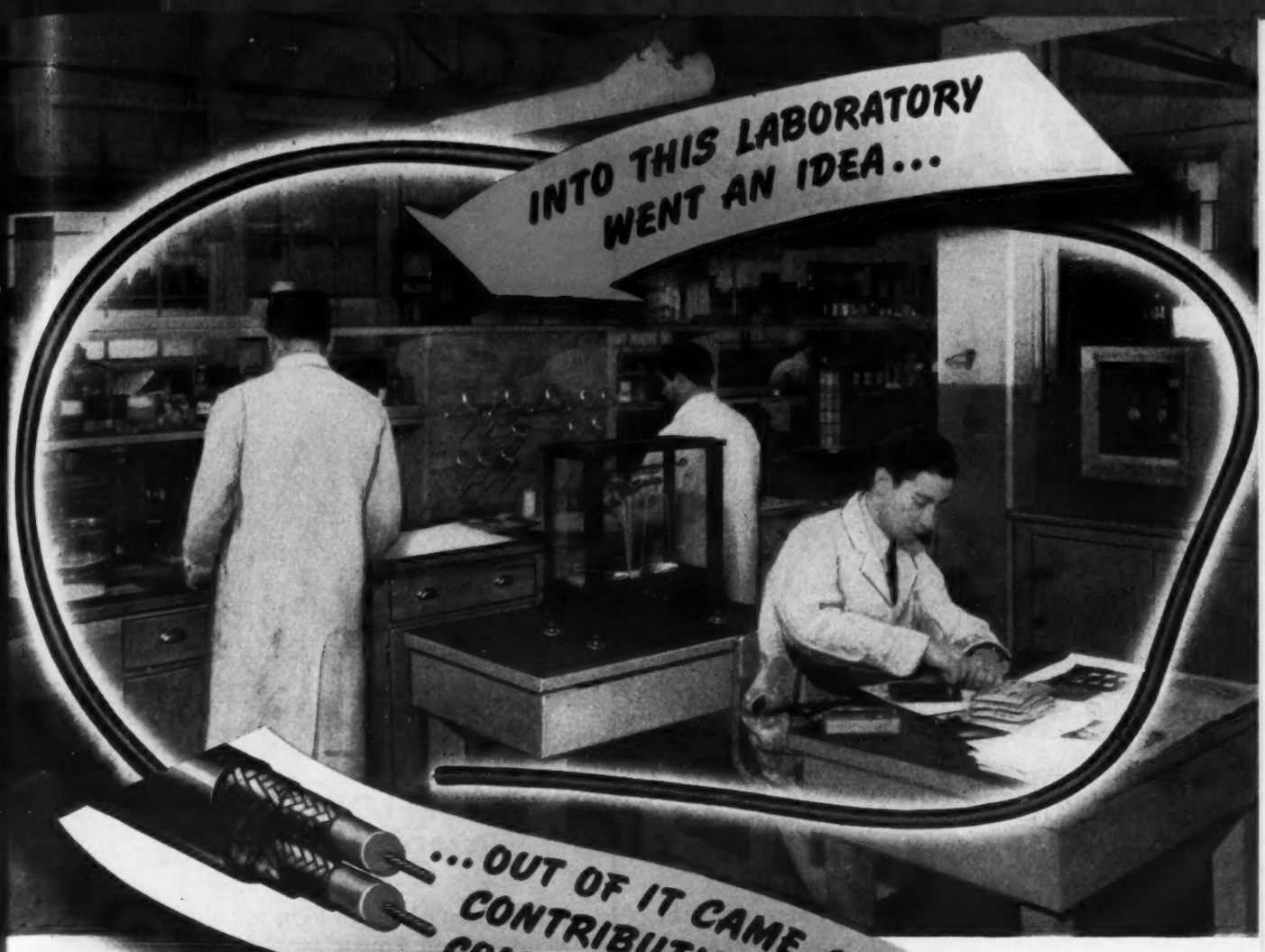
AMERICAN TRANSFORMER COMPANY
178 Emmet Street, Newark 5, New Jersey

* Saving copper, reducing line losses, obtaining improved voltage regulation or added load flexibility.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERTRAN
MANUFACTURING SINCE 1901 AT NEWARK N. J.

AMER-TRAN



Intelin Ultra High Frequency Transmission Line

Precision workmanship and intensive step-by-step inspection insure the perfection of Federal Crystals — now flowing in an endless stream to vital military applications.

When the war began there was no Ultra High Frequency Transmission Cable available to meet military needs for special radio applications.

Federal, with its unsurpassed research and production facilities, enlisted to fill the breach. Chemists and engineers, working day and night, developed the first dielectric that would fully meet the severe electrical and physical specifications of tough military requirements. Result: INTELIN Ultra High Frequency Coaxial Transmission Line . . . a major contribution to the science of radio communication.

Federal, from the beginning of its cable manufacturing activity, has made research and development the keystone for the establishment of Federal technical leadership in the high frequency cable field.

This outstanding technical ability has been applied to the solution of any and every cable problem submitted—and is now a focal point for the development of high frequency cables for the military and for industry.

Again Federal leads the way!

Federal Telephone and Radio Corporation

An IT&T Associate

Newark 1, N. J.

New Ampac A-C WELDER Makes Big Hit!

SUPERINTENDENTS LIKE AMPAC BECAUSE:

▶ They get a wider operating range with the Allis-Chalmers Ampac "400"—50 to 500 amps. That means they can schedule a greater variety of welding output on both *thick* and *thin* metals without changing machines.

▶ They don't have to provide a 3-phase line when they install Ampac — as they do with d-c welders. Ampac uses *any* standard a-c voltage: 220-440 and 208 v, 60 cycle.

▶ Ampac's lower initial investment makes sense to them. Its simplified construction and quick installation produce a big saving over comparable d-c units.

▶ They like Ampac's low maintenance. Ampac welders need only a 15 minute inspection and lubrication twice a year. Less time *out* for service—more time *in* for production.

▶ Ampac's simplicity means longer life, more dependable service. There are only three moving parts to wear.

▶ Power bills are reduced by as much as 50% after switching from d-c welders to Ampac.

WELDERS LIKE AMPAC BECAUSE:

▶ They don't have to fight arc blow . . . there's *none* with an Ampac a-c welder!

▶ They do better work — get sound, uniform welds with Ampac's steady power flow. That also means they can weld in deepest corners without reducing speed.

▶ They like the easy, quick way they can adjust Ampac power. Seven turns of the control wheel covers the entire welding range.

▶ They find Ampac easier to move over rough floors. Wheels available are *oversize.*

▶ Any accidental damage to Ampac's case does *not* affect the structure of electrical parts within. Case serves only as a protective shell.

▶ They know they can stay on a job until it's done . . . because Ampac's oversize, extra-rugged parts can take it. The new Ampac was designed in wartime for 24-hour-a-day war production.

▶ Get the full story on this brilliant new welder from our nearby Ampac dealer or A-C District Office. Allis-Chalmers, Milwaukee 1, Wis.

♪ *Tune in the Boston Symphony, Blue Network, every Saturday at 8:30 pm, EWT.*

ALLIS-CHALMERS AMPAC "400"

A 1702

THE THING THAT REALLY COUNTS CAN NEVER BE STANDARDIZED!

HOW can there be any difference in station insulators when elaborate standards have been set up to control practically every detail of their design? Dimensions, electrical characteristics, mechanical strength, and even predicted service performance are covered by tests or specifications...If it were possible to specify just one more thing, a station insulator could be bought as you would buy sugar or salt at the corner grocery--not asking or caring who made it.

But, you can't specify what a manufacturer must know or how diligently he applies that knowledge. Here is where all the difference comes in. *This is what you're really buying.* This is what never shows up in a test, yet "sticks [out like a sore thumb" ten or twenty years later...You can be right twenty years from now by specifying O-B station insulation today, and we can back up this statement with the largest and longest service records in the industry.

ARMY E NAVY
MANSFIELD PLANT

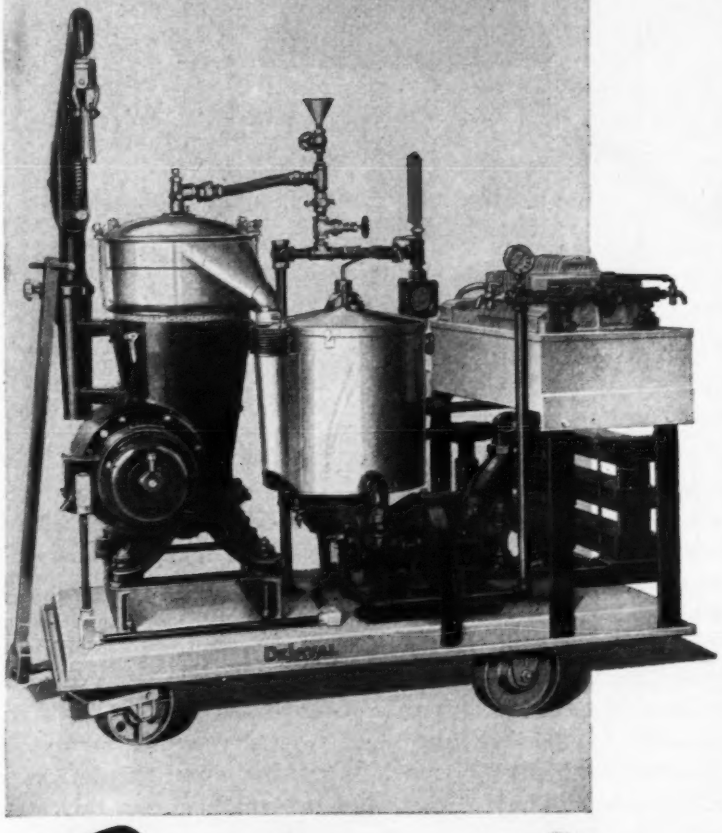
Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONTARIO

2472-H

MAINTAIN INSULATING OIL AT *Lowest Cost* AND *Highest Efficiency*



DE LAVAL Insulating Oil Purifiers are used by leading power systems largely because of one outstanding superiority: they purify and dehydrate the oil most completely at a single pass. As a result, there is a greater daily output of thoroughly dehydrated oil; operating costs are lower; and the oil can be maintained economically at a uniformly high dielectric value.

In the De Laval Centrifugal Insulating Oil Purifier, water is discharged continuously and oil is purified at a relatively low, non-carbonizing temperature. Automatic oil flow control and thermostatic heat regulation make practically automatic operation possible. (Except for removal of colloidal carbon from circuit breaker oil, no filter media are used.)

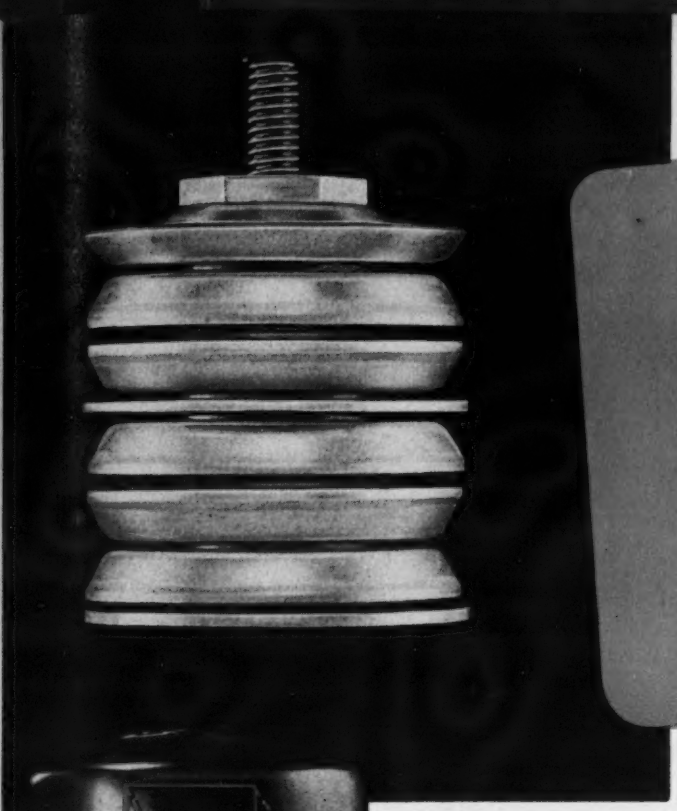
De Laval Insulating Oil Purifiers are available in several sizes, both as portable and stationary units. Write for additional details.

●

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

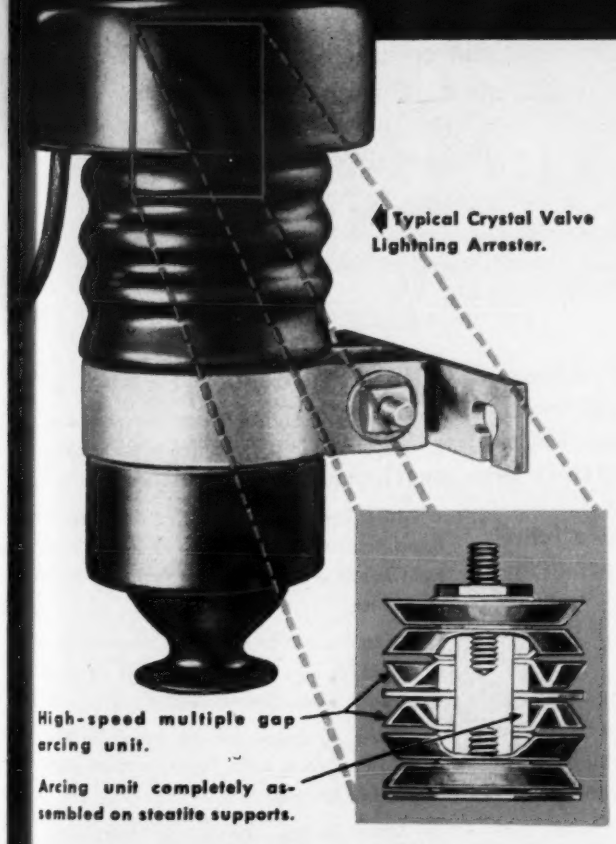
De Laval

INSULATING OIL PURIFIERS



LIGHTNING ARRESTERS must be FAST

Typical Crystal Valve Lightning Arrester.



High-speed multiple gap arcing unit.

Arcing unit completely assembled on steatite supports.

SPEED of operation of a lightning arrester is a measure of the protection it will give to equipment; speed of operation is controlled largely through spark gap design and construction; hence spark gap assemblies are vitally important elements of lightning arresters.

For 30 years lightning arresters of our manufacture have embodied spark gap units of the same basic design illustrated herewith; these incorporate two fundamentally correct major features:

1—A multi-gap structure.

2—Sparkover or discharge surfaces that are smooth and flat.

Electrodes are coin-pressed to high accuracy before assembly; accurately ground steatite elements are used to space same; electrodes and spacers are assembled on a steatite rod; a costly structure—yes, but one possessing exceptionally good electrical and mechanical characteristics, highly accurate and uniform operation, short time lag and therefore high speed of operation, heavy surge current discharge capacity—*all of which cooperate with other important features of the Crystal Valve in giving highly efficient protection and long service life.*

More detailed information on the construction, operation, protective characteristics, etc. of Crystal Valve lightning arresters will be found in our current catalog. Write for a copy.

CRYSTAL VALVE *Lightning Arresters*

ELECTRIC SERVICE MANUFACTURING CO.

Former name—Electric Service Supplies Co.

17th AND CAMBRIA STREETS, PHILADELPHIA 32, PENNSYLVANIA

Branch Offices or Distributors in Principal Cities and Foreign Countries

Stocks Located at Strategic Points for Quick Delivery

CENTRAL STATION ON WHEELS

ONE of the worst blows inflicted by retreating enemy armies is knocking out the local electric light plant. Whenever this happens, one of the new Westinghouse power trains moves in, hooks up to outgoing lines and re-establishes service to the community.

Unfailing electric service *here at home* is equally important, and plant operators are insuring against power failures by lubricating with TEXACO.

Texaco Regal Oils (R & O), for example, keep steam turbine systems clean, bearing temperatures normal, governor action smooth and sensitive. These oils free themselves rapidly from air and water, are highly resistant to gum formation and sludging and *are rust and oxidation inhibited.*

So effective have Texaco lubricants proved that they are definitely preferred in many fields, a few of which are listed on the right.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States.

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ *More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.*

★ *More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.*

★ *More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.*

★ *More revenue airline miles in the U. S. are flown with Texaco than with any other brand.*

★ *More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.*

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

"SWINGING BUS" *proves highly satisfactory*

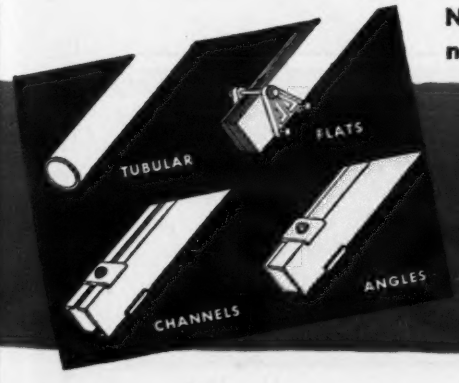
Buses are 5" aluminum channels, held face to face by welded-on spacers.

They're war workers, these Alcoa Aluminum buses, carrying power for vital production. Suspended from standard power-line insulators, with spans 24 feet rather than the usual 8 feet, costs were much lower than for rigid bus bar construction.

Buses are free to swing. The stiffness of the two Alcoa Aluminum channels comprising each conductor permits this long span design. The standard lengths supplied by Alcoa were welded at the joints to make each run a solid unit. The aluminum supplies the high electrical conductivity required.

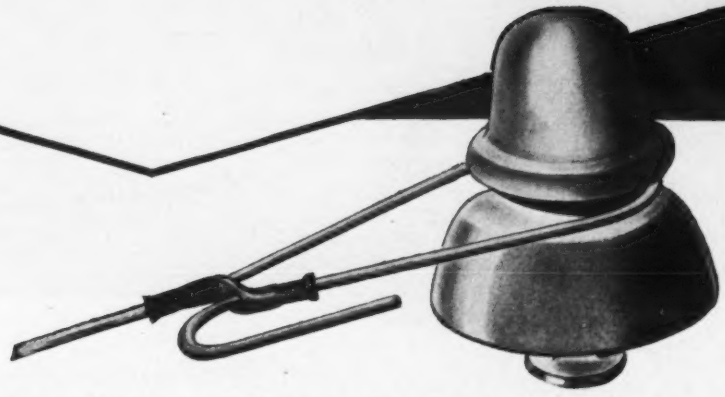
Alcoa bus bars, Aluminum Cable Steel Reinforced, and fittings are available for essential work. If your power project has been approved, Alcoa can supply the necessary materials. With them, of course, goes the usual Alcoa engineering advisory service. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Pa.

Note to manufacturers of electrical equipment: W.P.B. Order M-1-l now permits the use of aluminum for electrical conductors.



ALCOA
ALUMINUM

Nicopress OFFSET DEAD ENDS offer Many Advantages



1 They are designed for use on copper, Copperweld and Copperweld-copper conductors.

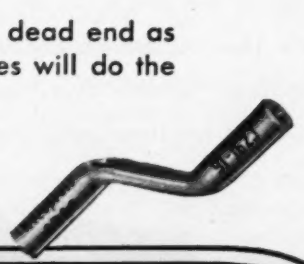
2 They can be installed on Pin, Strain or Spool insulators.

3 Simplicity and speed of installation.

4 Strength and tightness.

5 Provide for a tail of any desired length.

6 No extra tools are required to make the offset dead end as the same tool used in making regular line splices will do the job. These convenient Nicopress Tools are small and compact and are extremely easy to operate close to the insulators or cross arms.



The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr. — N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor — INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

● **Amerclad Type S** is a heavy-duty portable cord for electrical tools and similar applications where the cord is subject to extremely rough usage. *Type SJ*, having a lighter jacket, is designed for use in homes, stores and offices.

● **Amerclad Welding (Electrode-Holder) Cables** feature extreme flexibility and light weight combined with typical Amerclad toughness. They are easy to manipulate, lie flat and can be moved without kinking or snarling.

AMERCLAD

. . . a bear for punishment
. . . a beaver for work

EVER notable for long life, Amerclad Cords and Cables are built tough to stand the hard knocks of wartime speed-up. Light, flexible and easy to handle, they can be pulled through puddles, dragged over rough ground, subjected to abrasive wear, or exposed to severe chemical action. Yet they keep right on delivering an uninterrupted flow of power. Their stamina is built in.

Even now, when crude rubber is not available and the use of Neoprene is greatly restricted, we have developed synthetic rubber compounds for use in Amerclad Cords and Cables to carry on the old tradition of trouble-free service.

Here's an invitation. Pick out your toughest portable cable job. Next time that cable needs replacement, use Amerclad. You should have the benefit of the time- and money-savings that Amerclad insures.

Building Wire — Rubber or Synthetic resin insulation
Non-Metallic Sheathed Cable
Service Entrance and Drop Cable
Power Cables — Rubber, Varnished Cambric or Paper Insulation
Armored Submarine or Parkway Cables
Non-Metallic Parkway Cables
Rubber-sheathed Cords and Cables
Heat-proof Asbestos Insulated Cables
Weatherproof and Annunciator Wire
Magnet Wire of all types and sizes
Galvanized Steel Wire and Strand
Rural Distribution Conductors.

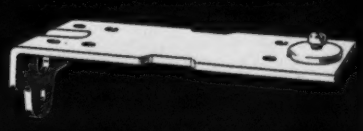
AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

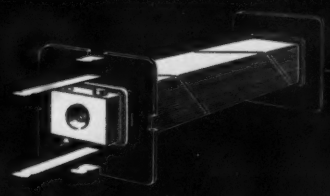
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

1. Slip-on covers of Bakelite or metal.



2. Heel piece of special magnetic metal.



3. Laminated core of low loss silicon iron.

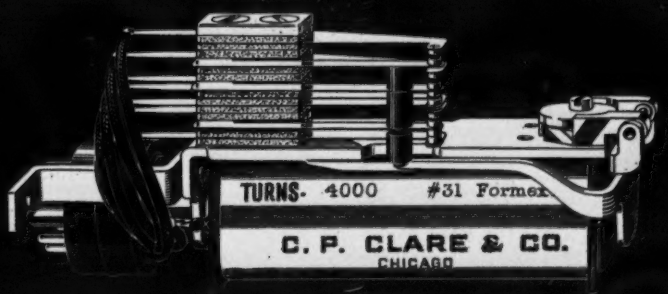
4. Pile-up insulators of special Bakelite.

5. Armature assembly; special magnetic metal; hard brass yoke with stainless steel shaft operating in Oilite bearings.

6. High voltage pile-up insulation withstands heavy break-down tests.

Contacts of rare metals and special alloys, "over-all" welded to nickel silver springs.

Spring bushing insulators made by a patented process from Bakelite rod. Illustration also shows twin contacts.



Clare Type A, a. c. Relay with Plug-in Mounting

CLARE TYPE "A" a.c. RELAY

For Utility Applications That Call For a Highly Efficient, Multiple Contact Relay

The Clare Type "A" a.c. Relay is especially valuable in utility applications that call for a multiple contact relay of unusually high efficiency. Meticulous attention to design, fine materials and precise manufacturing all contribute to the long life and dependability of the Clare Type "A" Relay.

These fine relays, applicable to innumerable circuit arrangements, are particularly suited for use in operating control panels . . . supervisory control boards . . . load dispatching centers where conditions are indicated from remotely located switches . . . circuit breakers, network protectors and other equipment.

Relays, as built by Clare, are engineered to meet known requirements. On the surface they may look similar to other relays. But dis-assembled, with each component part open for inspection, the reasons for the superior strength and dependability of Clare Relays is easily apparent. On this page are displayed many of the high quality individual parts which Clare design "custom-builds" into a relay of the rugged construction required in many utility applications.

All Clare Relays are really "custom-built." They can be supplied with various types of mountings, special contacts and a wide variety of contact arrangements.

Clare engineers are ready at all times to assist you in the development of a Clare "Custom-Built" Relay to meet any new or unusual requirement. Send for the Clare catalog and data book. C. P. Clare and Company, 4719 West Sunnyside Avenue, Chicago (30), Illinois. Sales engineers in all principal cities. Cable address: CLARELAY.

C L A R E R E L A Y S

"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use

Flexible Cables

FOR PORTABLE AND MOBILE Electrical EQUIPMENT

Rubber sheathed flexible cords and cables for portable or mobile electrical equipment were made first by Simplex and introduced about twenty-five years ago. They quickly proved their superiority for such service over older types of cables and were soon in general use.

Simplex-TIREX - rubber sheathed - cords and cables have been the acknowledged leaders in this field ever since. Improvements made from time to time have maintained their leadership and millions of feet of tough, abrasion resistant Simplex-TIREX are in service today.

Recent government regulations prohibit the use of natural rubber in insulation or sheath. Synthetic compounds have been developed to carry on for the duration and already have proved their ability to render satisfactory service. They will fill in now for the Simplex-TIREX that, during the past quarter century, has built up such enviable performance records in mines, mills and wherever electrical equipment depends upon flexible conductors for power.

SIMPLEX *War* TIREX——

cords and cables with synthetic insulation and sheath are available for essential projects. If you need cords or cables for machines or tools engaged in war work, you should learn what Simplex "War" Tirex cords and cables can do for you.

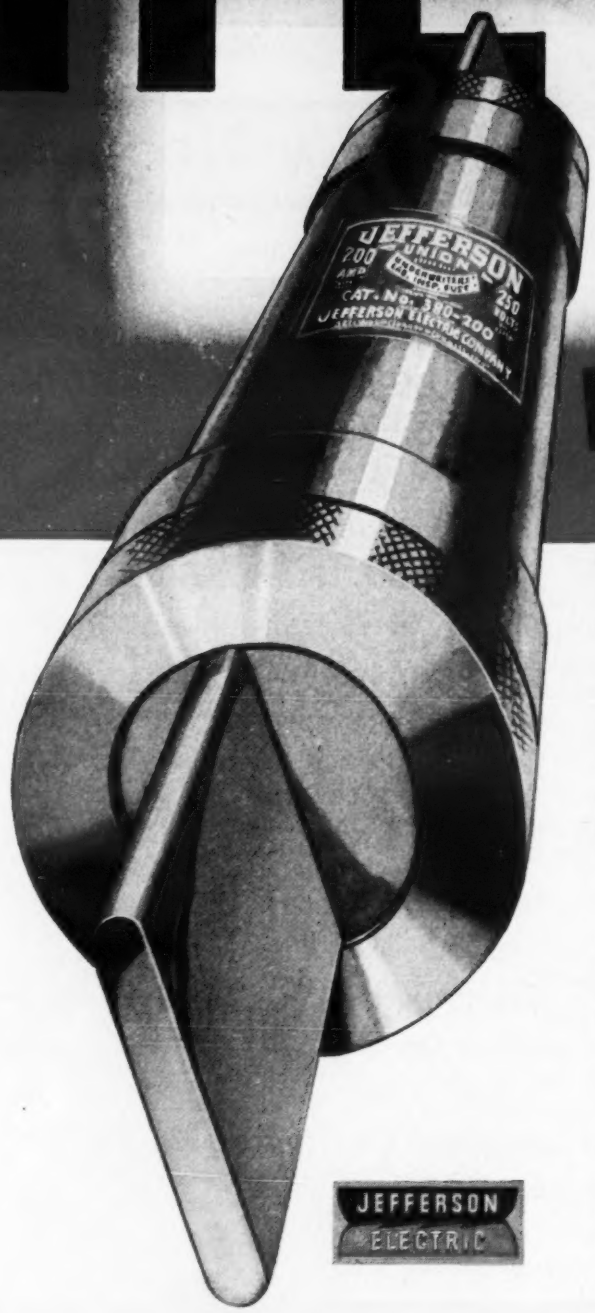
Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex

WIRES and CABLES

HEAT

THAT TURNS METAL TO GAS—



A Good Renewable Fuse Must Withstand This

What a demonstration of fuse construction achievement is emphasized every time a fuse "blows".

An inferno of heat inside the fuse transforms the strip of cold fuse metal to a gas. Heat and pressure have dealt the fuse casing a shocking blow,—a blow good renewable type fuses must withstand.

To be sure of the full value and economy of renewable type fuses it will pay you to specify Jefferson-Union Fuses. JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. Canadian Factory: 60-64 Osler Ave., W. Toronto, Ont.

JEFFERSON UNION
RENEWABLE FUSES

Can we help you apply PREHEAT *Engineering?*

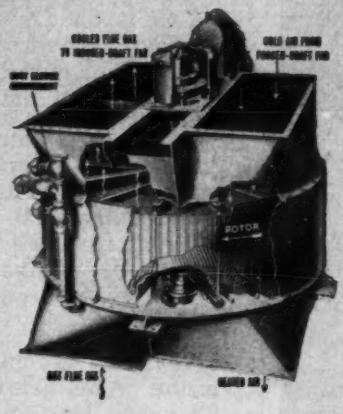
Our preheater experience, applied in close co-operation with leading designers of boiler plants and industrial furnaces, helps to improve combustion, to raise heat recovery and to solve unusual heat-transfer problems.

PROVED ON WARTIME JOBS LIKE THESE:

1. **ORDNANCE PLANT BOILER**, fired by powdered coal, is assured efficient combustion by combustion air heated to 502 deg F.
2. **SYNTHETIC RUBBER PROCESS**, requiring 1400 F steam uses a separately-fired superheater equipped with a Ljungstrom air preheater.
3. **REFINERY CRACKING FURNACE** has Ljungstrom preheater "designed in", saving alloy steel in convection tube banks.

HOW THE LJUNGSTROM AIR PREHEATER OPERATES

In the Ljungstrom, the heating surface is incorporated in a compact, slowly rotating cylindrical unit. It acts to "soak up" the heat in the gas chamber and then, upon rotation, to liberate it to the entering air. By means of this *continuous regenerative counterflow* principle, the maximum transfer of heat is obtained with minimum weight and size. One inch in height of Ljungstrom heating surface is equivalent to one foot in height of tubular or plate surface.



THE AIR PREHEATER CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.

WING DUCTS made by FRINK help give them speed!

One American-built fighter plane has proved especially effective against the Nazis in Russia. It is deadly efficient at surprising and strafing enemy troops from house-top heights. "Shaving," our Russian allies call it. They call the plane "Little Shaver."

"Little Shaver" owes much of its effectiveness to its speed. Its speed depends in part on its cooling system. And that's where Frink comes in. Frink makes the aluminum ducts that rush cold air from the leading edge of the wings back to the engine. Without this cooling draft of air the engine would quickly over-heat and stall.

The Frink Corporation has specialized in precision manufacturing and engineering for 86 years. During that time the name Frink has become synonymous with quality and skill in the lighting industry.

A pioneer in Fluorescent illumination as well as Incandescent lighting, The Frink Corporation developed LINOLITE, the famous "engineered for vision" Fluorescent equipment now giving such efficient and profitable service in many of America's foremost factories, stores and banks.

Today Frink is heavily engaged in producing war equipment. Tomorrow Frink will resume engineering and manufacturing the high-quality lighting equipment that has gained such an enviable reputation in the industry.

LIGHTING SINCE 1857

THE FRINK CORPORATION
BRIDGE PLAZA NORTH
LONG ISLAND CITY 1, N.Y.

Subsidiaries: Sterling Bronze Company, Inc.
Barkon-Frink Tube Lighting Corporation

★ ★ ★ ***All** Frink employees **invest** at least **10%** of their earnings in **War Bonds.*** ★ ★ ★

WE ARE PROUD OF THAT RECORD. LET'S ALL BUY WAR BONDS!

Is ELECTRONIC HEAT PRACTICAL FOR YOUR HEATING PROBLEM?

ELECTRONIC HEATING of non-metallic substances is sometimes considered expensive — sometimes considered cheap. This is because it has been used in a wide variety of applications, each with its own peculiar characteristics. In any application, the *overall* cost comparisons should be made in relation to the results obtained. These comparisons should include initial outlay for equipment, operating costs, savings in time, improvement in product, and many other considerations.

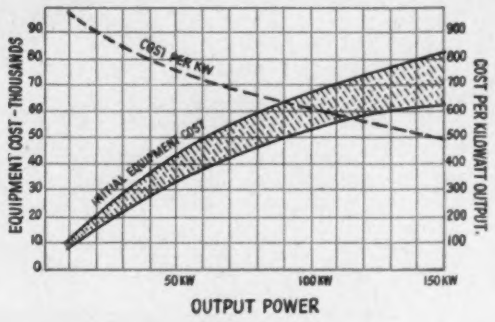
INITIAL COST: Curve A shows the initial cost of electronic heating equipment up to 150-kw output (540,000 BTU per hour, max.). Cost per rated kw-output is lower for high-power than for low-power units. Reasonable expected life of an electronic generator is at least 25,000 hours of operation.

MATERIAL HEATED: In electronic heating of non-metallic substances, high-frequency electricity, generated by electron tubes, is "passed through" the material to be heated. The electrical energy is converted to heat; when the material is homogeneous, it is heated uniformly throughout. Some materials are easier to heat than others. Curve B gives an indication of the efficiency of power-to-heat conversion for various substances. In some applications, electronic heat is used to supplement other methods of heating. For example, preheating a material to produce uniform temperature all the way through often improves results when the material is finally placed in an oven.

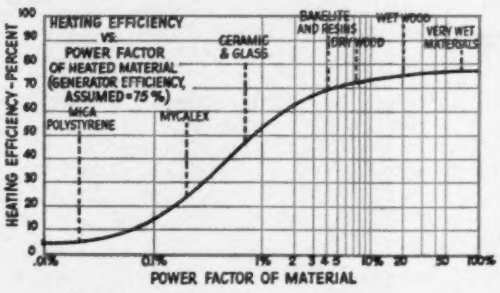
OPERATING COST: Operating cost includes power, and tube replacement. An average figure (based on a 15-kw generator) is 3¢ per kw-hour, or about 1¢ per 1000 BTU *output*. Since electronic heating involves shorter time-cycles than other heating methods, objects heated by electronic means usually lose little heat by radiation or conduction to surrounding objects. Hence, electronic heating usually involves less BTU output from the heat source than other heating methods.

CONCLUSION: Once again, it is pointed out that the improvement in results when electronic heating is used must be considered in comparing the cost to that of other heating methods. For example, plastics molders have been able to increase press output by 50% when electronic preheating was used. Compregwood propeller molding time was reduced 67% by electronic heat.

Send the coupon for further information. Radio Corporation of America, Electronic Apparatus Section **(70-45F)**, Camden, N. J.



• CURVE A—*Initial cost of electronic generators and cost per rated kw based on a number of installations made by different manufacturers.*



• CURVE B—*Assuming a 75% efficiency for the electronic generator, the overall efficiency of an electronic heating installation depends on power factor of the heated material, as shown.*

RCA ELECTRONIC HEAT

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION, CAMDEN, N. J.

LEADS THE WAY . . . In Radio . . . Television . . . Tubes . . . Phonographs . . . Records . . . Electronics

FREE

BUY WAR BONDS

RCA, Electronic Apparatus Section, Camden, N. J.

Please send me details on the new RCA 15-B electronic generator.

Name.....

Company.....

Address.....

City.....State.....

70-45F

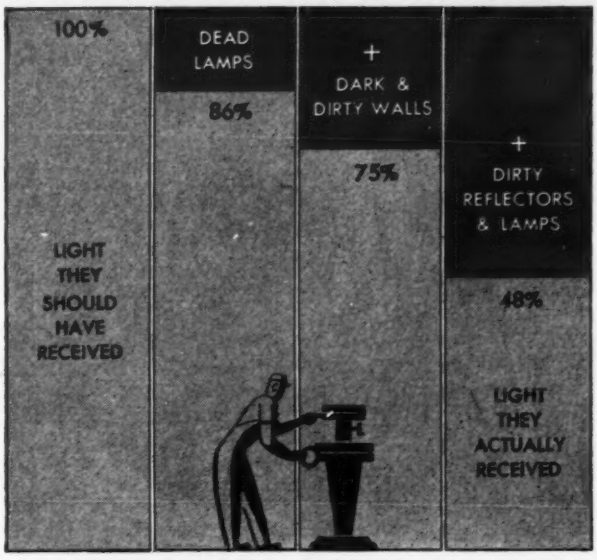
Fluorescent operating hints

No. 3 of a series published by SYLVANIA for all users of fluorescent lighting

HOW TO GET THE LIGHT YOU PAY FOR

Observing a few simple operating rules can prevent waste of as much as 50 per cent of the fluorescent light you buy.

For example, here is the waste caused by improper maintenance in one typical plant:



Dead lamps left in fixtures rob this plant of 14% of the light that is being paid for — dark and dirty walls, of 11% more—dirty reflectors and lamps, of 27% more. Why get only half of the light that simple maintenance will bring you?

SCHEDULING MAINTENANCE SAVES DOLLARS IN LIGHT

Schedule regular checking and cleaning. All you need is a lightmeter.

Whenever the meter shows that you are receiving 25% less light than you should—it's time to check for dead lamps, and to get out the soap and water.

Attend to dead lamps first. Unless they are cut out of the circuit, they tend to overheat ballasts, wear out your starters, and waste electricity. But before you discard lamps, be sure the fault is not in the starters, ballasts, or circuit.

"TWO-MAN TEAM" MAINTENANCE METHOD

All you need to insure clean lamps and reflectors is plenty of soap and water—plus a *regular* maintenance schedule. The following two-man method has been proved very successful.

1. Two-man team begins work with one clean reflector previously removed from a fixture near the end of the cleaning route.

2. At first fixture on the route, man on ladder removes lamps and reflector, hands them down to man on floor in exchange for previously cleaned reflector. Ladder man then cleans housing, side panels, etc.

3. Ladder man secures clean reflector in place. (No hand tools are required with Captive Latches on Sylvania Industrial Fixtures). Man on floor wipes off the lamps and passes them back to ladder man.

4. Ladder man, with supply of Sylvania Starters, reinstalls cleaned lamps and sees that fixture is working properly.

5. Ladder man descends and puts ladder in place at next fixture. Meanwhile, man on floor washes and dries the first fixture and has it ready to replace soiled reflector in the next fixture.

Follow this procedure through entire installation.

HOW OFTEN?

Frequency of cleaning depends upon the location of installation and the type of work it lights. Air-filtered and air-conditioned rooms may require fixture cleaning only once in six months. But cleaning may be necessary every few weeks in a factory where the atmosphere is heavy with dust and oil. Be guided by your lightmeter in scheduling cleaning.

For Additional Maintenance Information

Send for this Free Booklet—

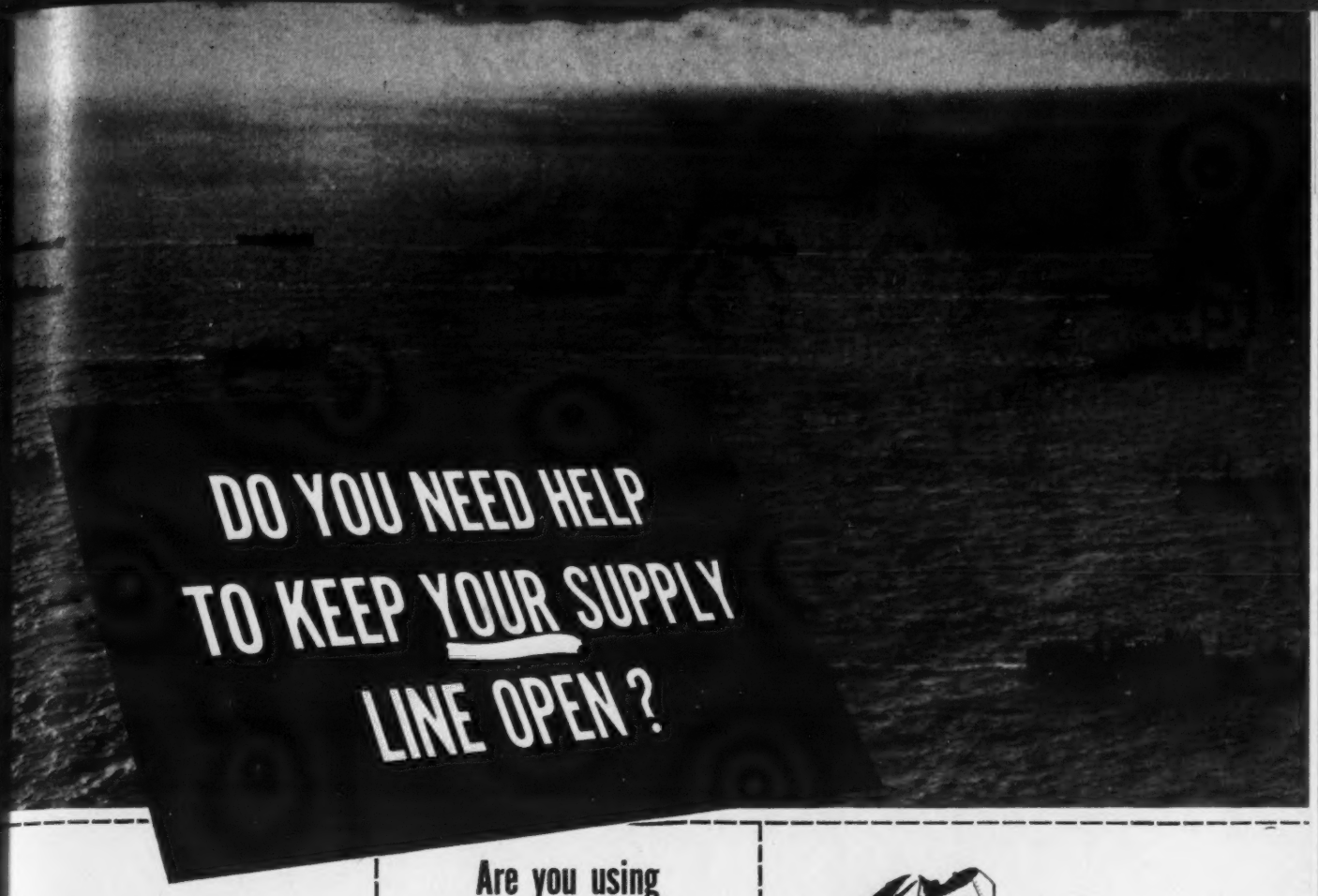
100,000 already distributed

SYLVANIA ELECTRIC PRODUCTS INC.

"Fluorescent at its Finest"

SALEM, MASSACHUSETTS

FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES



Need General Purpose Steels?

Many a war job has been speeded up by a call to one of our warehouses. Our stocks, even today, are large. So if you need steel, steel products, machinery and equipment, we'll get it to you quickly if at all possible—subject, of course, to priority requirements. A call to us has saved many a situation. Try us—you'll get prompt, courteous attention. Phone, write or wire our nearest warehouse.

Are you using National Emergency Alloy Steels?

These wartime steels have proved a boon to hundreds of defense plants in meeting conditions imposed by shortages of critical material. In many cases they have performed even better than steels ordinarily used. We have been able to help many of our customers with these steels. If you have any problems connected with their use, we'll gladly assist you in determining the grades best suited to your needs.

For Welding Needs

We can supply Welding Wire, for electric arc welding, such as:

STAINLESS STEEL ELECTRODES
HARD-SURFACING ELECTRODES
MILD CARBON ELECTRODES

We also offer Welding Machines, Protect-O-Metal for elimination of weld spatter and Havens "C" Protected Clamps. Write, phone or wire our nearest warehouse.

UNITED STATES STEEL SUPPLY COMPANY
USS
STEELS
SERVICE

Send for FREE copy of our new Stock List and Reference Book

UNITED STATES STEEL SUPPLY COMPANY

CHICAGO (90),	1319 Wabansia Ave., P. O. Box MM	Teletype CG. 605	BRUnswick 2000
BALTIMORE (3),	Bush & Wicomico Sts., P. O. Box 2036	Teletype BA. 183	GILmore 3100
BOSTON (34),	176 Lincoln St., Allston, P. O. Box 42	Teletype BRTN. 10	STAdium 9400
CLEVELAND (14),	1394 E. 39th St.,	Teletype CV. 153	HEnderson 5750
MILWAUKEE (1),	4027 West Scott St., P. O. Box 2045	Teletype MI. 587	Mitchell 7500
NEWARK (1), N.J.,	Foot of Bessemer St., P. O. Box 479	Teletype NK. 74	Bigelow 3-5920
			REctor 2-6560 - BErgen 3-1614
PITTSBURGH (12),	1281 Reedsdale St., N. S.	Teletype PG. 475	CEdar 7780
ST. LOUIS (3),	21st & Gratiot Sts., P. O. Box 27	Teletype SL. 384	MAin 5235
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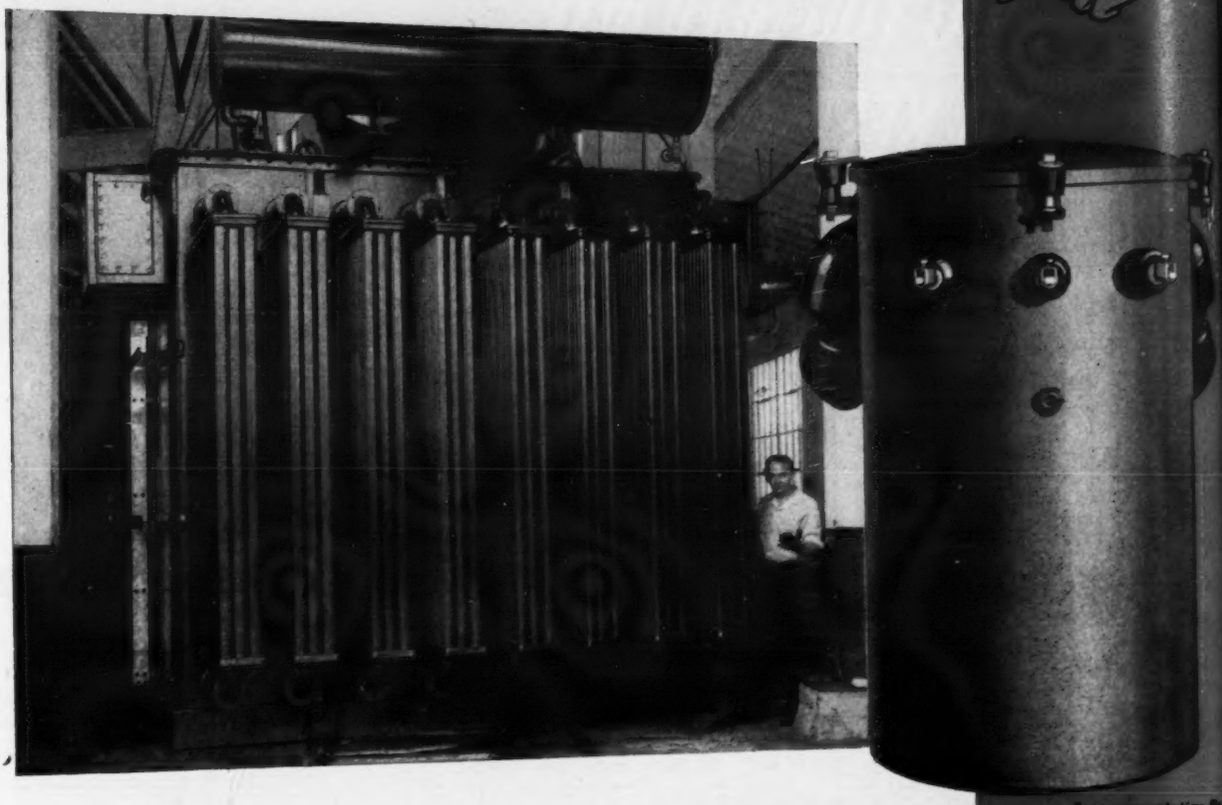
UNITED STATES STEEL

TRADE MARK

Standard TRANSFORMERS.

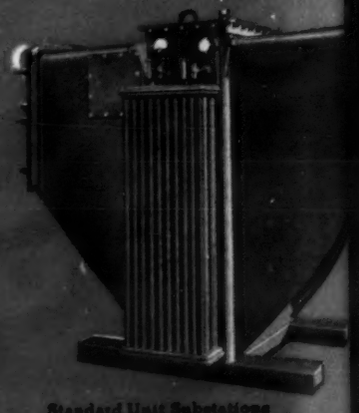


A representative Standard Distribution Transformer

Dependability and efficiency in transformer operation comes only when a sound engineering design is reproduced accurately in steel, copper and insulating materials. The pictures on the opposite page show some of the manufacturing operations through which this is accomplished in one typical Standard transformer. Skill, careful workmanship and modern manufacturing practice are combined here to produce transformers that are reliable and economical.

If you want transformers "Engineered to your needs"—call upon Standard. With a capable, experienced engineering staff, a modern, flexible manufacturing set-up and an organization trained to meet urgent production requirements, Standard can deliver the *right* transformers on time!

The illustration above indicates the complete range of sizes made by Standard. From the small unit in the man's hand to 10,000 KVA. sizes, in oil, Pyranol (Askarel) and air-cooled types, Standard transformers *accurately reproduce* our engineer's designs.



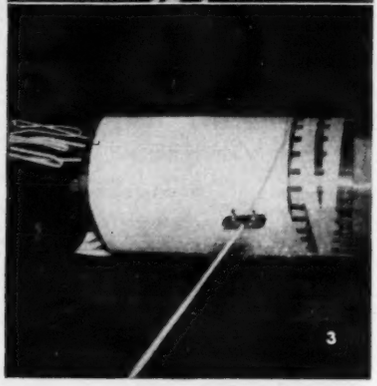
Standard Unit Substations save space, installation time and cost.

THE STANDARD

built to your specifications

from *Service-proved* designs

STANDARD CONSTRUCTION FEATURES MEAN BETTER SERVICE



1 *Silicon alloy steel of high permeability and low in loss is used for Standard Transformer Cores. It is annealed to relieve rolling strains, treated on both sides with special core plate varnish (which is impervious to hot oil) and sheared to size. Eddy current and other core losses are thus kept to a minimum.*

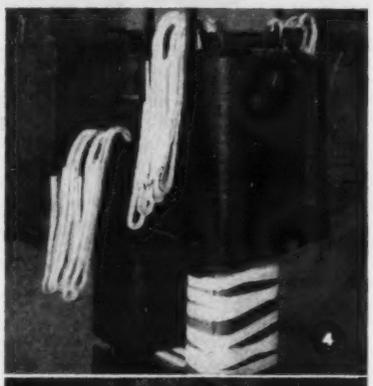
2 *Because the reliability of a transformer is a function of the strength of its insulation, Standard takes special pride in this feature of construction. Exceeding the dielectric test requirements of both the AIEE and NEMA, the insulating materials used by Standard amply protect the coils against flashover, moisture and other hazards.*

3 *This illustration shows high voltage coils, near completion. Note how taps are thoroughly insulated where they are brought out at the left. Shown also are the ends of treated fibre spacers, placed lengthwise in each coil to facilitate the flow of cooling medium between coil layers.*

4 *After the winding is completed, the coils are preheated to 125 degrees Centigrade, vacuum-impregnated with special moisture-resisting varnish and baked. The varnish completely penetrates the insulation, and when baked, forms a weather-proof sheath.*

5 *In building up the core legs, laminations are staggered so that joints at top and bottom of the legs are made by interleaving connection yokes with the laminations to form a butt-lap joint. This gives the core structure great mechanical strength and minimizes the exciting current.*

6 *The sturdy mechanical construction of Standard Transformer coils is shown here. Exceptional care is taken to obtain perfect centering of high voltage coils over the low voltage coils. This is a necessary precaution against a telescoping effect caused by accidental short circuits.*



TRANSFORMER COMPANY

WARREN
OHIO

CENSORED CENSORED

The sad case of a Case History

CENSORED

Many an achievement in the war effort is "born to blush unseen". . . at least for the present. The case history, complete with photographs and diagrams, cannot now be revealed.

In many ways General Electronics Industries has been helping to establish the great war record of electronics, through cooperative research with industrial organizations and Army and Navy research agencies. Present conditions do not permit a full recounting of these achievements.

General Electronics Industries is one of the largest organizations specializing in electronics. And this organization, which has met the exacting tests of war, has the research engineering skill and production facilities that will best answer your electronics needs when the war is over.

Engineering Department, General Electronics Industries, 342 West Putnam Avenue, Greenwich, Connecticut.

GENERAL *Electronics* INDUSTRIES

TRADE-MARK REG. U.S. PAT. OFF.

GREENWICH • STAMFORD • BRIDGEPORT • NEW MILFORD NEW YORK

How to Use Available Benjamin Lighting Units to Make Needed Lighting Improvements Now

FROM THE AVAILABLE BENJAMIN LIGHTING UNITS LIKE THESE, CAN BE SELECTED FIXTURES TO PROPERLY LIGHT EVERY SEEING TASK

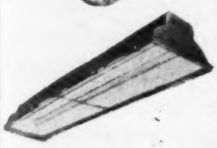
RLM DOME PORCELAIN ENAMEL UNIT—The accepted standard for general lighting. Provides illumination on both horizontal and vertical surfaces with minimum of shadow; high lighting efficiency.

ELLIPTICAL ANGLE PORCELAIN ENAMEL UNIT For wide, even distribution of light from the side; also where there are overhead obstructions . . . too high ceilings . . . vertical surfaces to be lighted.

RLM BOWL PORCELAIN ENAMEL UNIT—For localized lighting of many machines, assembly and inspection operations involving difficult seeing conditions which may require exceptionally high footcandles running up to 50 to 75 or more footcandles.

EXPLOSION-PROOF . . . DUST-TIGHT UNITS—For lighting locations involving explosive atmospheres or explosive inflammable dusts, a complete line of Benjamin Explosion-Proof and Type II-G Dust-Tight Units are available.

WATER-TIGHT UNITS—Benjamin "Vapolet" lighting fixtures are recommended for such locations as boiler rooms, pump houses, power houses, hydro-turbine rooms, chemical plants, ice houses, loading platforms, basements, quarries, pits and other locations where weather-proof and water-tight units are essential.



TYPE II-G SEALED-FLO FLUORESCENT UNIT—This porcelain enamel unit is designed for use in dusty, dirty, damp locations where high lighting levels are essential. It is listed by Underwriters' Laboratories for certain hazardous locations.

MERCURY VAPOR LIGHTING UNITS—Best seeing conditions for certain seeing tasks are obtainable through the use of Benjamin Mercury Lamp Units or combination mercury and incandescent units. These are available in a complete range of lighting units which include Dome, Elliptical Angle and Glassteel Diffuser types.

ELLIPTO-LITE FLOODLIGHT UNITS—for protective floodlighting of factory yards and grounds and for lighting outdoor work areas, these porcelain enamel open-type Benjamin Ellipto-Lite units provide effective illumination. For complete data on Benjamin Floodlighting equipment see Catalog 26.

A lighting checkup made now will uncover many locations where production experience reveals the need for improved lighting to improve workmanship, increase production, increase safety, reduce fatigue or improve employee morale.

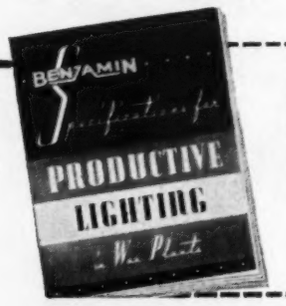
These lighting problems require for their solution the correct selection and installation of lighting units that meet every requirement of the location as well as the seeing task.

From the available Benjamin Lighting units, proper lighting can be provided . . . lighting that is correct from the viewpoint of sufficient light, quality of lighting, light distribution, light diffusion, light control, shielding, maintenance and safety.

Send for Free Manual of Lighting Problem Solutions

In this 32-page guide to Productive Lighting in War Plants are contained 21 ready to use solutions of the lighting problems most commonly encountered in industrial production. Use of this guide and the data contained in Catalog 26 will enable you to specify Benjamin Lighting units to meet practically every seeing requirement. For a complimentary copy sent without cost or obligation, write Product Information Dept K, Benjamin Electric Mfg. Co., Des Plaines, Ill. or MAIL COUPON TODAY.

BENJAMIN TRADE MARK
Lighting Equipment
Distributed Exclusively Through Electrical Wholesalers



Benjamin Electric Mfg. Co., Product Information Dept. K, Des Plaines, Illinois

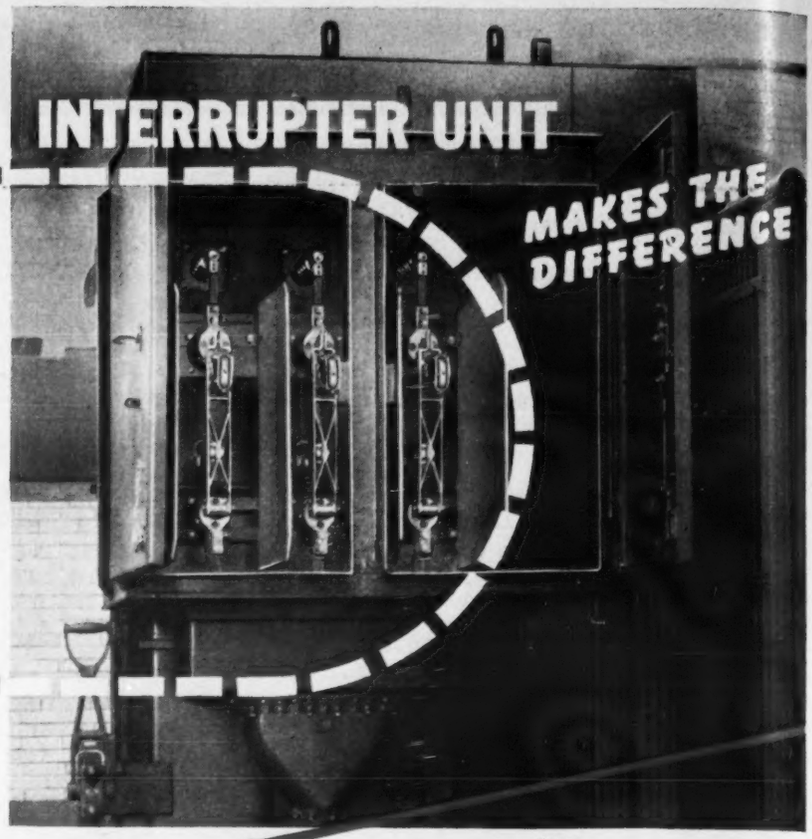
☐ Please send me, without cost or obligation, a copy of the Manual . . . Specifications for Productive Lighting in War Plants.

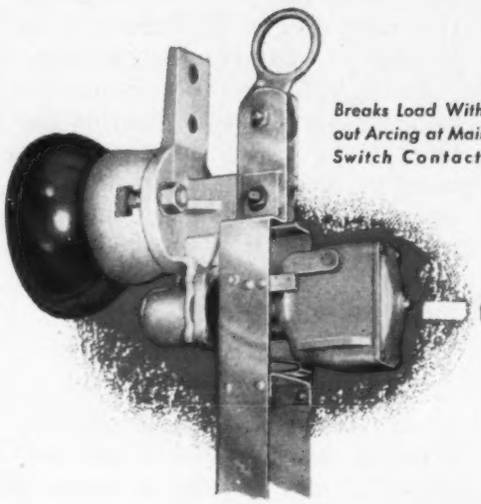
Name .....
Company .....
Address .....
City ..... State .....

THIS MODERN LOAD-SWITCHING

Saves Space, Installation, Operating and Maintenance Costs

THE S&C INTERRUPTER UNIT





Breaks Load Without Arcing at Main Switch Contacts

These S&C Load Interrupter Disconnects were applied for interrupting the magnetizing current of a 1000 KVA, 13.8 KV, 3-phase transformer, and for emergency switching under full-load conditions. They were chosen on performance records of these switches as proved in hundreds of representative utility and industrial installations—chosen because of definite savings and overall reliability.

Get the facts about these and other savings on your new installations where safe, dependable load switching is required. Write for Bulletin 202-A.

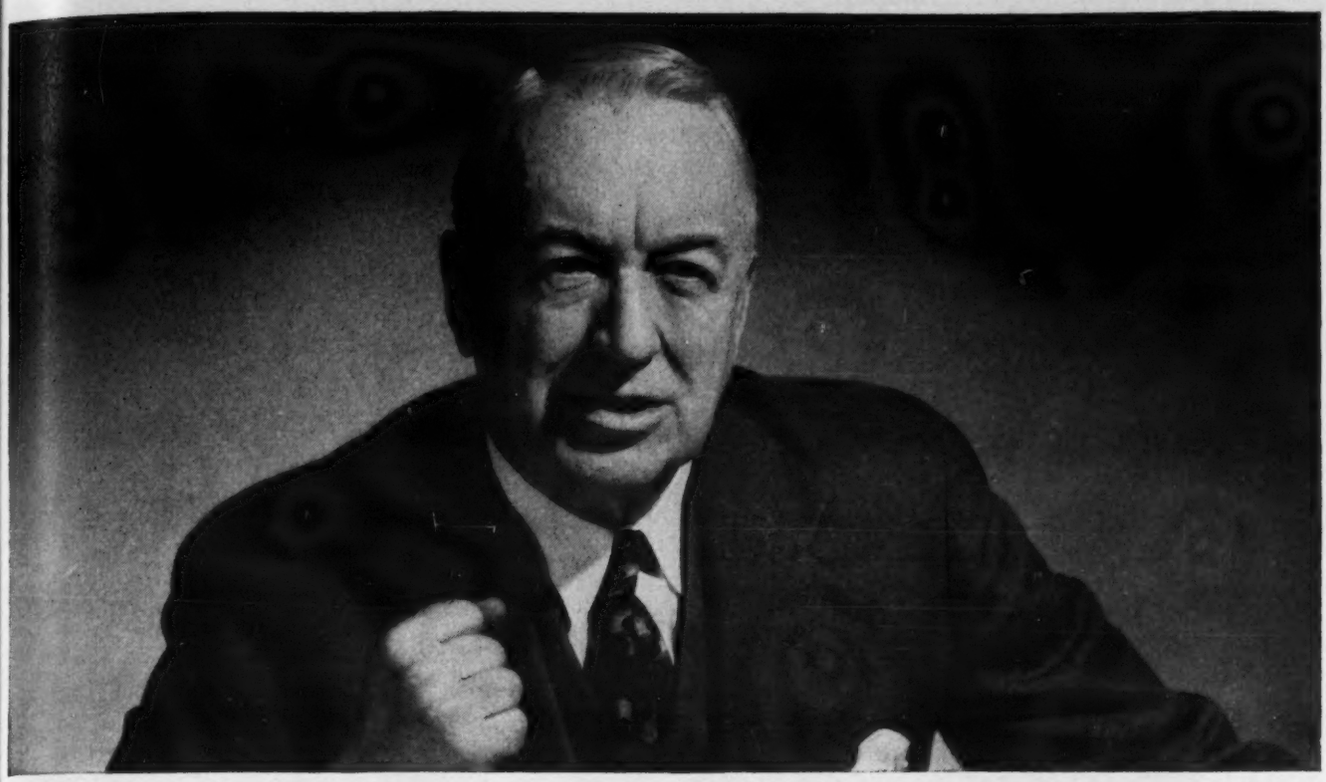
★ ★ ★

S&C Load Interrupter Switches and Power Fuse combinations also have found wide application in: sectionalizing feeder circuits under load, emergency load-switching of sub-station transformers, isolating feeder taps and capacitor banks.

SCHWEITZER & CONRAD, INC.
4435 Ravenswood Ave., Chicago 40
Supplied in Canada through Powerlite Devices, Ltd., Toronto, Ontario

LOAD INTERRUPTER DISCONNECT

WITH S&C INTERRUPTER UNIT



We've got the drop on "Load Drop"

"We're not waiting for 'load drop' to get serious because of terminated war contracts. We've taken time by the forelock and we're doing something about it now—checking over our commercial customers to see who should be first to install electric cooking."

List Your Commercial Cooking Prospects

You'll find commercial cooking and baking concerns are sure prospects for electric cooking. They now use electricity for lighting, motors, ventilation and refrigeration. With our help, add electric cooking and double your revenue. Many are tired of humoring obsolete equipment and are ready to go modern at the first opportunity. Some are eligible right now for Hotpoint-Edison Commercial Cooking Equipment.

Give them this news about recent priority regulations.

If present equipment is inadequate or beyond repair, they should consult their local Hotpoint-Edison distributor or write to us. New government regulations now permit manufacture of a limited quantity of equipment for essential civilian use.

Notice how Hotpoint-Edison advertising reaches hotels, restaurants, bakeries, hospitals and institutions — in their own trade publications. This is helping you. Take advantage of it. Make a survey of those who are planning new buildings or remodeling. Show them how economical, simple and convenient it will be to bring in only the one fuel for lighting, power, and cooking.

Start Now to Get the Drop on "Load Drop!"

Edison General Electric Appliance Company, Inc.
5618 West Taylor Street, Chicago 44, Illinois.

For outstanding achievement ARMY E NAVY **in War Production**

THE KITCHEN OF TOMORROW WILL BE ALL-ELECTRIC

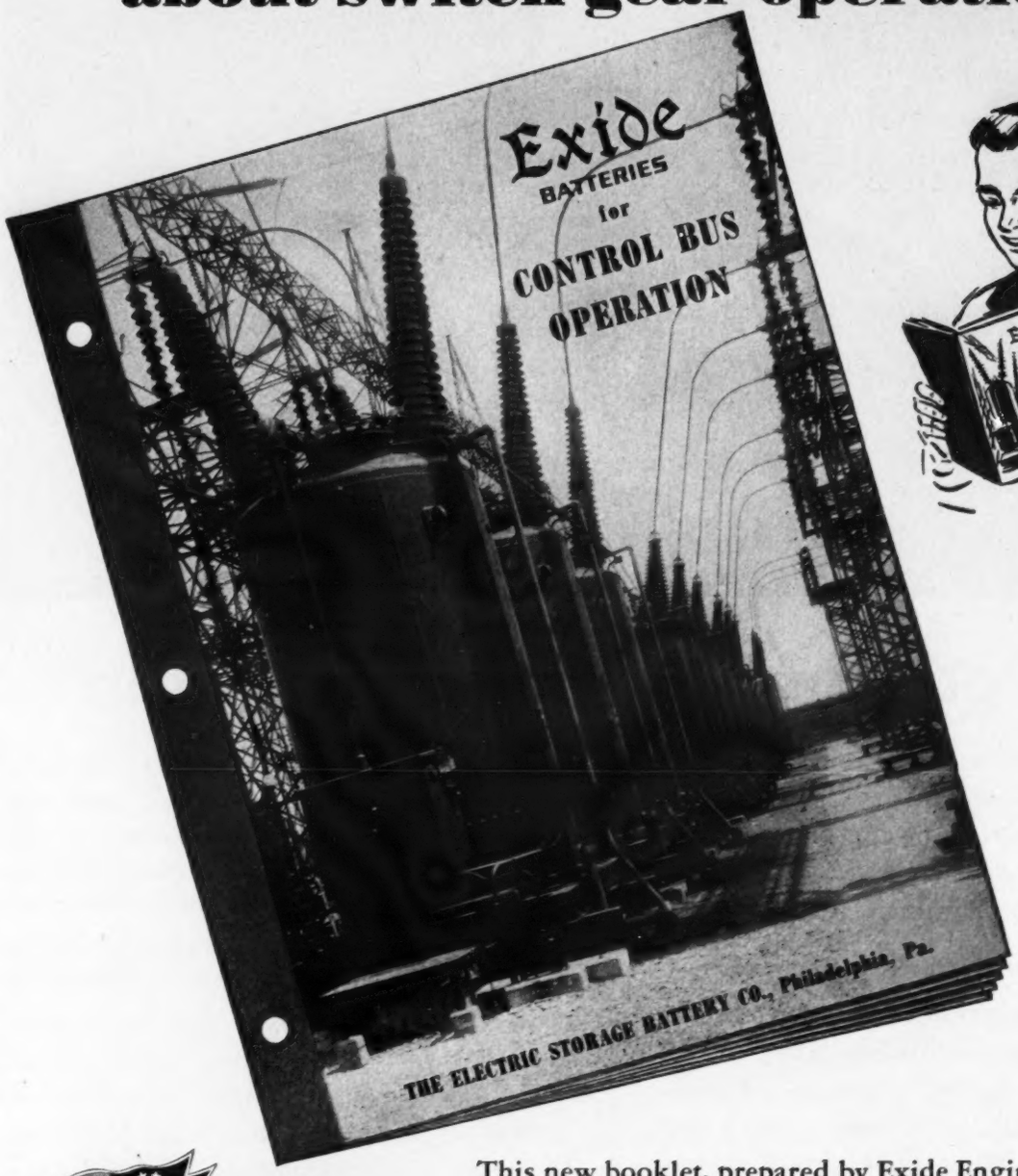
Hotpoint Edison

COMMERCIAL ELECTRIC COOKING EQUIPMENT
RANGES • BAKE OVENS • ROASTING OVENS
DEEP FAT FRY KETTLES • BROILERS • GRIDDLES

OLDEST AND LARGEST MANUFACTURERS OF ELECTRIC COOKING EQUIPMENT

FOR VICTORY — BUY U. S. WAR BONDS AND STAMPS

"Just what I wanted to know about switch gear operation."



ARMY E NAVY

Exide
CHLORIDE
BATTERIES

Exide makes several types of storage batteries for control bus operation, the most popular of which is the Exide-Chloride Battery. Exide-Chlorides have earned the confidence of engineers everywhere, and their widespread use in public utilities and private industrial plants is proof of their dependability.

This new booklet, prepared by Exide Engineers, contains factual information of interest to all engineers engaged in the application of switch gear. The installation of storage batteries in power stations and substations has become standard engineering practice. This new booklet not only tells how to attain adequate and uninterrupted current supply, but gives complete information on types of batteries used . . . selection of battery . . . method of operation . . . maintenance and charging . . . and many other facts you should know. If you are interested, write for a FREE copy today.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

WATER PUT OUT THIS OIL FIRE ...WATER IN Water FOG FORM!

FROM FIRE TO OUT IN 2 SECONDS!

Plain ordinary water *can* be used to fight dangerous flammable liquid fires successfully. WaterFOG works where a solid stream of water or even spray is ineffective. Why? The answer is basic physics — speed of heat absorption increases with surface area exposed to heat.

By transforming impinging streams of water into minute fog particles, Rockwood WaterFOG nozzles greatly expand the total surface area of a given volume of water. These particles completely envelop the combustion area — quenching the flames, then cooling the oil surface, retarding vaporization. Finally the foglets expand into steam, shutting off oxygen.

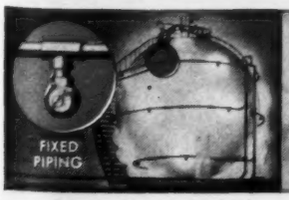
Thus WaterFOG destroys what it takes to make fire: heat, vapor, oxygen. And unlike solid water or spray, WaterFOG floats gently into the combustion area—doesn't plunge into the liquid to accelerate vaporization.

Rockwood installations are approved by Underwriters' Laboratories and Associated Factory Mutuals. Fixed piping installations and hose nozzles. Write for free Bulletin 123, describing how WaterFOG, a nonconductor, absorbs more heat, cools wider area, prevents "flash-back" and lessens water damage.

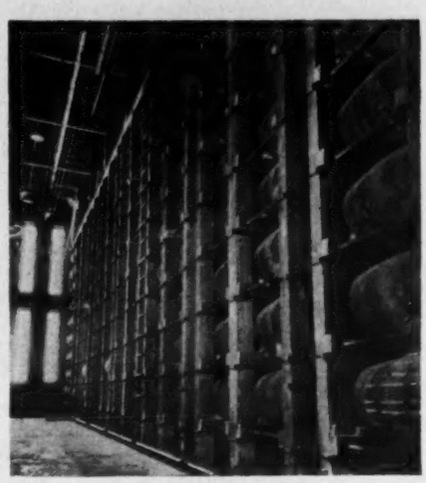
ROCKWOOD SPRINKLER COMPANY
62 Harlow St., Worcester 5, Mass.
Specialists in Fire Protection Engineering, Equipment and Installation since 1907

ROCKWOOD Water FOG

Water Engineered by Rockwood Cools, Confines, Smothers Oil Fires



ROCKWOOD WaterFOG Equipment Protects Bonded Warehouse



At Melchers Distilleries, Ltd., Berthiersville, Quebec, an automatic WaterFOG Deluge System protects the whiskey warehouses from destruction by fire.

WaterFOG system in test operation. Fan-shaped curtain of WaterFOG fills aisle between racks of barrels. WaterFOG can also be discharged from heads under racks.

Fixed Piping Installations for Many Hazards

Wherever flammable liquids are stored, processed or transferred, a Rockwood-engineered installation of fixed piping, heads, valves and automatic control devices will provide maximum protection from fire. In planning such systems, Rockwood engineers (authorities on hydraulics, as applied to fire protection) make individual recommendations for spacing of heads, fog pattern, distance of heads from hazards, etc.

Typical installations are:

WaterFOG Protection for

- transformers
- oil switches
- control rooms
- generators
- paint shops
- oil storage

etc.

Write for Bulletin 123, giving more complete information on WaterFOG equipment.

EXECUTIVES! A colored movie (16 mm.) showing tests of Rockwood WaterFOG, is available.

★ ★ WAGNER PRODUCTS FOR VICTORY ★ ★

Wagner Unit Substations are doing their part in the production of steel, synthetic rubber, oil and other vital materials.

Wagner
UNIT SUBSTATIONS
PROVIDE LOAD CENTER CONTROL FOR LIGHTING AND POWER CIRCUITS

The Unit illustrated above is installed in a synthetic rubber plant. Each transformer has a two-position liquid-filled disconnecting switch on the high-voltage side which is equipped with low-voltage interlock. The low-voltage side is equipped with air circuit breakers electrically or manually operated, ground indication lights, voltmeters, ammeters, and ammeter test blocks. Each unit has one main breaker, one tie transfer breaker, and two feeder breakers.

MOTORS
TRANSFORMERS
UNIT SUBSTATIONS
INDUSTRIAL BRAKES
BRAKE LINING

ARMY E NAVY

For Complete Information on Wagner Unit Substations write or phone the nearest Wagner branch office.

NATIONAL SECURITY AWARD

BACK THE ATTACK—
BUY U. S. WAR BONDS

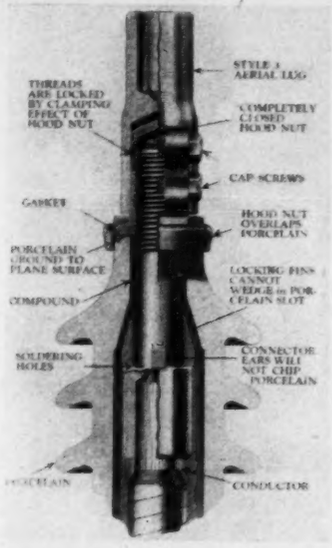
T44-3

Wagner Electric Corporation
ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

Here's POSITIVE PROTECTION

FOR LEAD SHEATHED CABLE ENDS

G & W POTHEADS



TYPE "T" CAPNUT TERMINAL

The top of the porcelain insulator is the most vulnerable part of a pothead. G&W capnut construction provides a simple and positive seal at that point. The hoodnut completely encloses the threaded connector stem. The hoodnut flange compresses the gasket on the top end of the porcelain. The aerial lug clamps the hoodnut onto the connector stem so securely that the assembly will not loosen under vibration.

FOR A PERMANENT TIGHT SEAL AGAINST ENTRANCE OF MOISTURE OR LEAKAGE OF CABLE OIL, TIGHTEN THE HOODNUT WITH A LARGE WRENCH. YOU WILL NOT BREAK THE PORCELAIN BECAUSE IT IS UNDER COMPRESSION.

G&W ELECTRIC CABLE DEVICES

G & W ELECTRIC SPECIALTY CO.

7780 DANTE AVENUE • CHICAGO, ILLINOIS

In Canada—Powerlite Devices, Ltd., Toronto, Ont.

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS

HIGH *discharge rate*

A PLANTÉ FEATURE

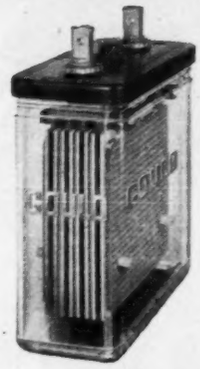
Call Gould

TO SOLVE YOUR BATTERY PROBLEMS

Rated Conservatively . . . Goulds equal or exceed in capacity any battery of comparable size and cell structure.

★

Are you receiving the monthly, informative "Gould Battery News"? If not, write for it.



• The rate of discharge and its corresponding voltage in sealed glass jar lead acid batteries is directly affected by the size and, more particularly, the design of the positive plates.

In the Gould Plante, the positive plates are spun to form vertical ribs of pre-determined cross-section and then electro-chemically treated to convert their surface to a uniform porous layer of lead peroxide. This design allows the electrolyte to circulate around and in between these ribs, exposing an unusually large area to chemical action, thus assuring a high rate of discharge.

Made of pure lead these positive plates have a regenerative quality . . . as the normal action of the cell wears away the outer surfaces, the pure lead core is, in turn, converted to lead peroxide to maintain this large surface area throughout the battery's long service life.

Get all the facts on the Gould Plante. Ask for the Gould Sealed-in-Glass Bulletin, using business letterhead.

GOULD STORAGE BATTERY CORP.

DEPEW, N. Y. • Factories at Atlanta, Ga. • Chicago, Ill. • Dallas, Texas Depew, N. Y. • Leavenworth, Kan. • Los Angeles, Cal. • North Bergen, N. J. • Sioux City, Iowa • St. Paul, Minn. • Zanesville, O.

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

GOULD

Since 1898 THE BATTERY PICKED BY ENGINEERS

HOW TO USE A HYDROMETER

One of a series of service suggestions for users of industrial batteries

▶ The hydrometer is a measuring instrument which provides a convenient means of gauging the amount of charge remaining in a battery. According to the U. S. Bureau of Standards it should be made of clear glass, with a smooth, circular cross section for the full length of the barrel carrying the float. The scale must be clearly marked and accurate to one-half of the smallest division shown.

Like any other precision instrument your hydrometer should receive periodic attention. The barrel and float must be kept clean, so the float will not stick to the sides. Ordinary soap and water is excellent for this purpose, if the barrel and float are thoroughly rinsed before reassembling. At this time it is also good practice to inspect the float for cracks which might allow acid to enter its air tight compartment and thus make any reading unreliable.

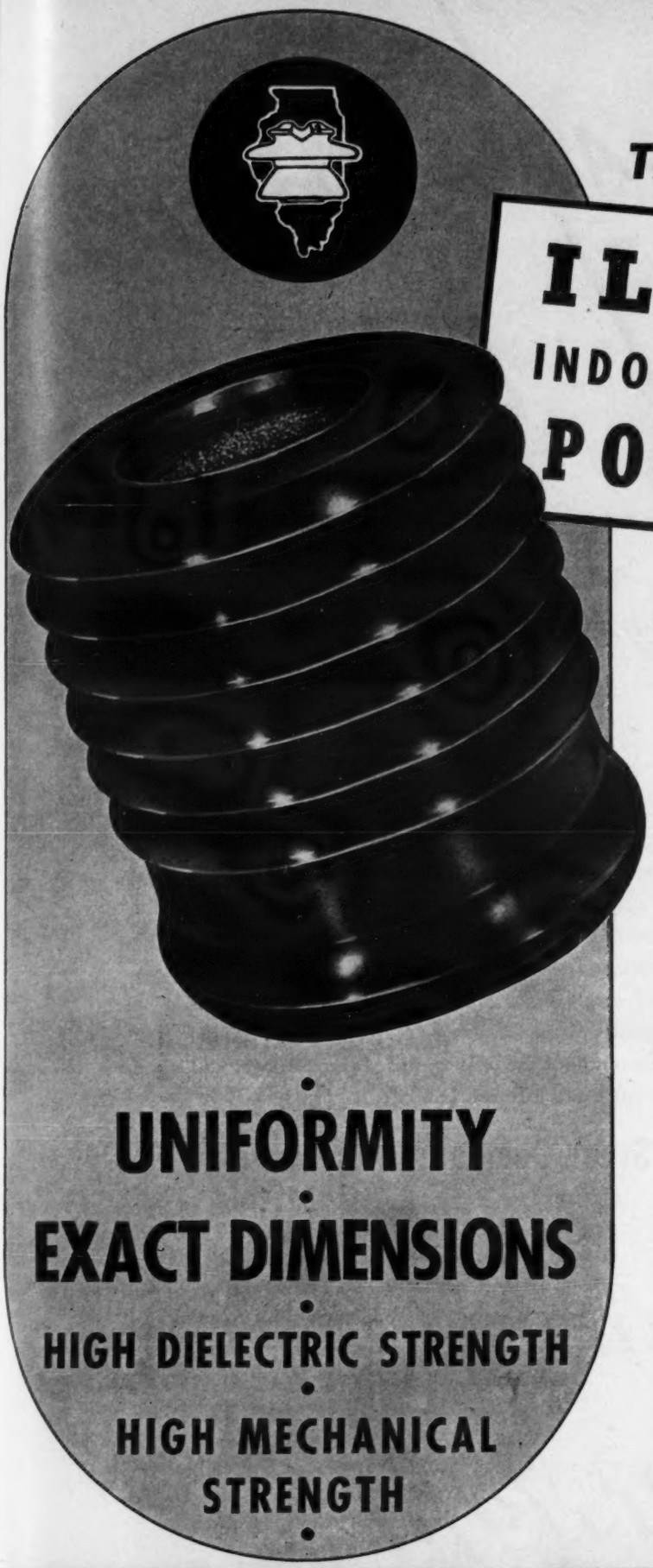
Actually a syringe type hydrometer gives an accurate indication of how much unused sulphuric acid remains in the battery's solution. This, in turn, is a convenient measure of the capacity remaining in a normal cell for, as it is charged, more and more acid is "driven from the plates into the electrolyte" giving it a greater specific gravity. Conversely, when being discharged the acid "leaves the electrolyte and enters the plates."

To assure accuracy in hydrometer readings, the liquid level of each cell should be normal when the reading is taken. If you have added water make sure that the electrolyte is thoroughly mixed. It is better to take hydrometer readings after charge. The gassing incidental to this charging mixes the water and acid in each cell and thus makes hydrometer readings more reliable.

In reading a hydrometer, it must be held vertical and sufficient electrolyte drawn up into the barrel to lift the float. The float must ride freely so that it touches neither the sides, top or bottom of the barrel.

The hydrometer reading is taken on the float scale at a point level with the liquid's surface. To do this hold the hydrometer at eye level and disregard the curvature of the liquid where the surface rises against the float stem and the barrel.

(Advertisement)



NO ASSEMBLY TROUBLES BECAUSE

ILLINOIS INDOOR BUS SUPPORT PORCELAINS

ARE ACCURATE THROUGHOUT • •

Production is controlled through every step of manufacture to insure exact dimensions in every ILLINOIS Indoor Bus Support. Modern processes all of the way, plus frequent inspections are contributing factors to the high dielectric and mechanical strength characteristics of ILLINOIS Porcelain.

The equipment manufacturers who regularly purchase porcelains for bus supports from Illinois are among the most satisfied customers.

The accuracy of dimensions on Illinois Bus Support Porcelains insures easier assembly of the finished equipment.

UNIFORMITY

EXACT DIMENSIONS

HIGH DIELECTRIC STRENGTH

HIGH MECHANICAL STRENGTH

ILLINOIS ELECTRIC PORCELAIN COMPANY *Macomb, Illinois*

EXTRA DIVIDEND ON A SOUND DECISION

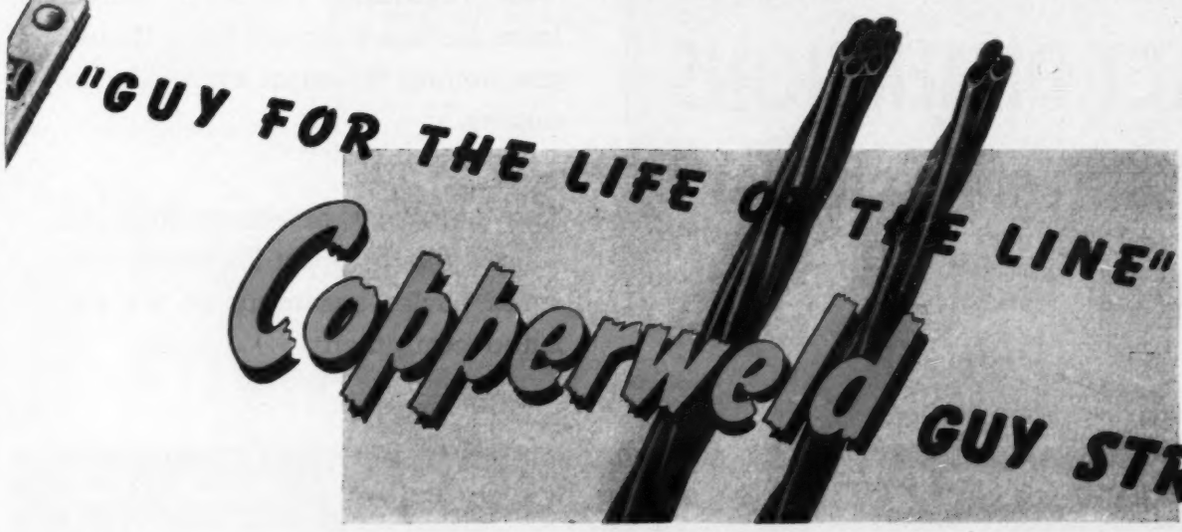
"WE DIDN'T EXPECT A WAR
WHEN WE STANDARDIZED
ON COPPERWELD GUY STRAND"

In normal times, the "regular dividend" on Copperweld guy strand is non-rusting long life. In these wartimes, Copperweld pays an "extra dividend," saving manpower and materials, by eliminating costly replacements of rusted guys.

The strong steel core of Copperweld strand is protected from rust by the thick exterior of copper inseparably molten-welded to the steel. You "guy for the life of the line" with Copperweld's copper-protected strength.

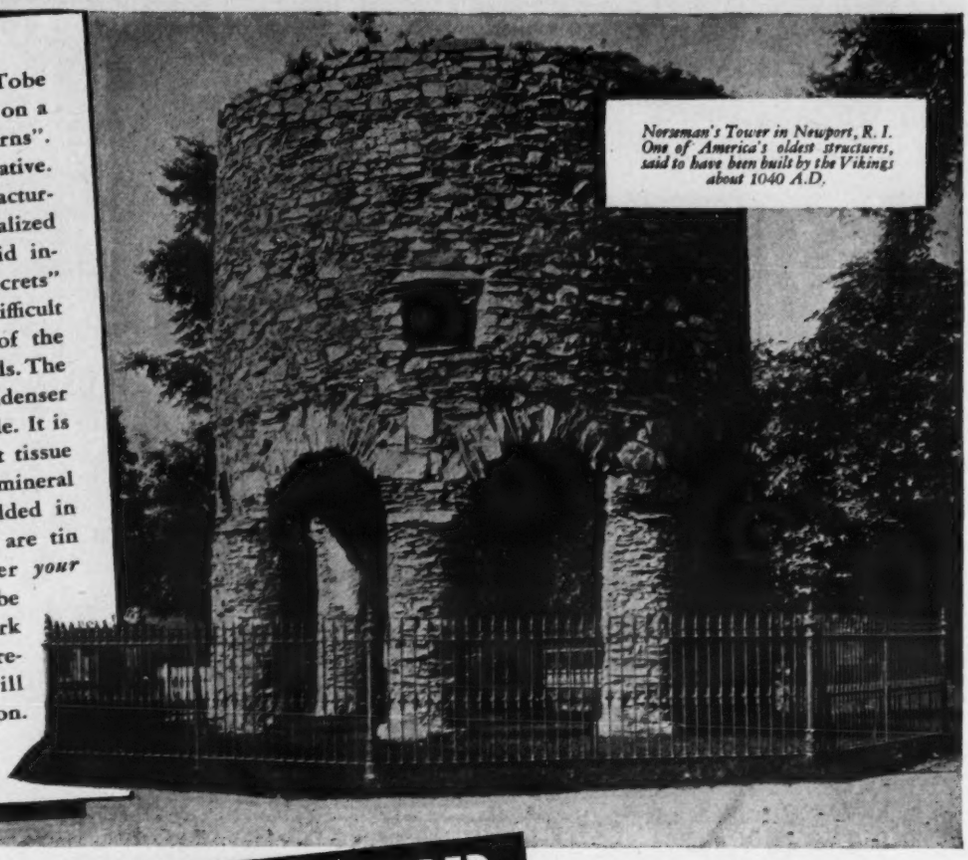
Plan to get the performance qualities that *only* Copperweld can give you. Our representatives throughout the country are at your service. Call upon them for further assistance and information.

Copperweld Steel Company · GLASSPORT, PA.



Stalwart *against* Time

THE REPUTATION of Tobe Capacitors for *long life* rests on a record of practically no "returns". Ratings are always conservative. Constant research . . . manufacturing skill born of long, specialized experience . . . frequent, rigid inspections—these are the "secrets" of Tobe's ability to master difficult specifications, like those of the new American War Standards. The "DP" Molded Paper Condenser shown below is an example. It is made of high grade Kraft tissue paper and aluminum foil—mineral oil impregnated and molded in low-loss Bakelite. Leads are tin copper wire. Whatever *your* condenser problems, Tobe engineers will gladly work with you. Inquiries and requests for samples will receive prompt attention.



Norseman's Tower in Newport, R. I. One of America's oldest structures, said to have been built by the Vikings about 1040 A.D.

LONG LIFE ASSURED

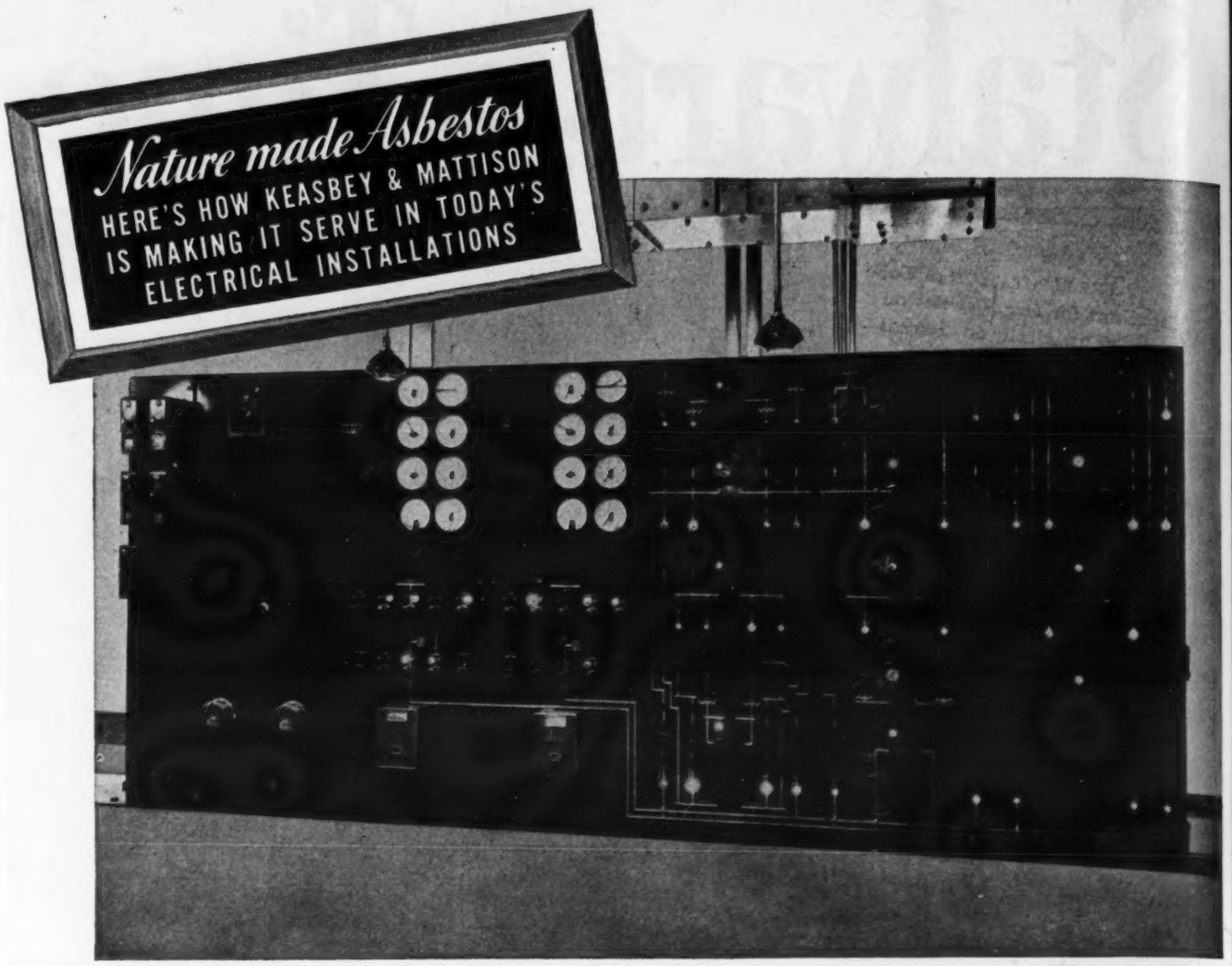
SPECIFICATIONS "DP" MOLDED PAPER CONDENSERS

CAPACITANCE.....001 to .04 MFD
WORKING VOLTAGE.....*See chart at right*
Flash test 3 times rated DC working voltage
SHUNT RESISTANCE At 185°F— 1000 megohms or greater
At 72°F—50000 megohms or greater
WORKING TEMPERATURE RANGE Minus 50° F to plus 185° F
OPERATING FREQUENCY RANGE..Upper limit 40 megacycles
Q at one megacycle—average 20
POWER FACTOR.....At 1000 cycles .004 to .006
DIMENSIONS.....13/16" x 13/16" x 19/64"

Capacity in MMFD.	DC Working Voltage Rating	TOBE & AMERICAN WAR STANDARDS DESIGNATIONS "A" Characteristic	"B"
1000	600—1500	CN35A102	CN35B102
1500	600—1500	CN35A152	CN35B152
2000	600—1500	CN35A202	CN35B202
2500	600—1250	CN35A252	CN35B252
3000	600—1000	CN35A302	CN35B302
4000	600—1000	CN35A402	CN35B402
5000	600— 800	CN35A502	CN35B502
6000	600— 800	CN35A602	CN35B602
7000	500— 700	CN35A702	CN35B702
8000	500— 700	CN35A802	CN35B802
10000	400— 600	CN35A103	CN35B103
20000	200— 300	CN35A203	CN35B203
30000	50— 150	CN35A303	CN35B303
40000	50— 100	CN35A403	CN35B403

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

A SMALL PART IN VICTORY TODAY A BIG PART IN INDUSTRY TOMORROW



Specially Designed for Modern Insulation Needs . . .

K&M EBONIZED ASBESTOS

Increased production facilities now make it possible for K&M to supply this superior mounting material again. Here is the *ideal* electrical insulation for switchboards, bus bar runs, testing tables, panel boards—designed to meet the most exacting requirements of modern installations.

K&M Ebonized Asbestos is made of asbestos fibre, binding cement and insulating compound —combined in proper proportions and molded into monolithic sheets under intense pressure.

Outstanding advantages of "Ebonized" are its exceptionally high dielectric strength—its ability to withstand severe shock, wide temperature variations and vibration—its resistance to the action of oil and water—and its freedom from shrinkage, cracking and bulging.

Our Ambler plants proudly fly the Army-Navy "E" flag—an honor awarded K&M employees "for outstanding production of war materials."

With our increased output we can supply you now with K&M Ebonized Asbestos in $\frac{1}{8}$ to 4-inch thicknesses, "standard" or special "panel" finish. K&M Ebonized Asbestos meets the technical requirements of the Underwriters Laboratories, Inc., when built into an assembled unit.

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

OWI Photo by Palmer in an Allegheny Ludlum plant

To this Flywheel, Many a Bomber

OWES ITS OWN ABILITY TO FLY

HAND BOOK OF SPECIAL STEELS

Newly revised and reprinted—a comprehensive book on the properties, uses, and best methods of handling, treatment, etc. of tool, stainless and other alloy steels. Plenty of tables to facilitate quick reference and selection. 136 pages, pocket-sized, latest data.

SEND FOR YOUR COPY

Address Dept. EW-21

WITHOUT special alloy steels, no modern bomber would fly . . . in fact, there are more of these materials in the big planes than any other single ingredient, a fact not so commonly understood.

Many of these special steels—electrical, corrosion and heat-resisting, valve and nitriding—first passed over the big breakdown mills in Allegheny Ludlum plants. Even more particularly, many of them were developments of our own research, and all of them are raw materials of the greatest portent for the future.

Special steels have eloquently demonstrated their ability to do for a product—perhaps *your* product—what ordinary materials cannot do. Let our Technical Staff help you to fit these tailor-made steels to your needs.

AL

STEEL FOR THE NATION'S WELFARE

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

Allegheny Stainless also handled by all Joseph T. Ryerson & Son, Inc. warehouses

W&D—A-9334

STRUTHERS-DUNN
INCORPORATED

5,288 TYPES OF RELAYS

Each available in
countless coil combinations

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DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND
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NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

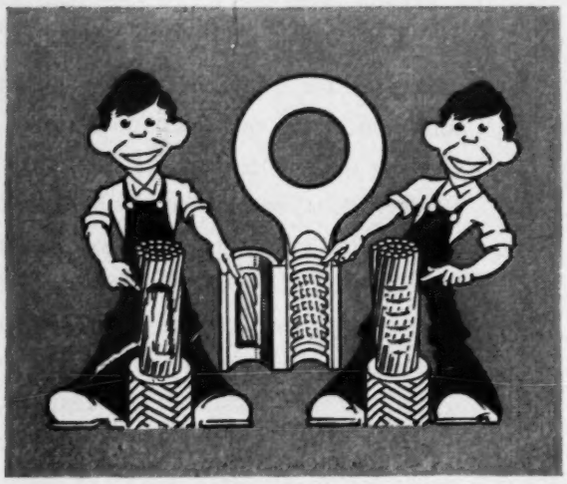
STA-KON* PRESSURE SOLDERLESS TERMINALS

STA-KON TERMINALS

in hundreds of shapes and sizes are standard with many utility companies. For control wiring, meter installations, relay circuits, lighting circuits and other uses in wire sizes from #22 to 250 M.C.M. They are installed with simple T&B Sta-Kon tools-manually or mechanically operated.

The high conductivity of all Sta-Kons is assured by the pure oxygen-free copper tongue that is in direct contact with the conductor. Once staked, the barrel of the Sta-Kon exerts tremendous pressure all around and throughout the wire. Constant low resistance of the electrical connection is assured by the design of the stake.

Note the long flat contact area running parallel to the strands. Also the four rounded corners bevelled at 45 degree angles, acting as buttresses that overcome any natural tendency of the metal to return to its original shape.



DISSECTION OF A STA-KON INSTALLATION REVEALS THESE OTHERWISE HIDDEN FACTS:

1 —Stake-mark has in no way damaged the strands.

2 —Individual strand markings on the under side of the stake-mark indicate contact pressure (approaching 40,000 lbs. per square inch).

3 —Strand markings across serrations on the tongue reveal area of pressure and contact.

4 —Serration impressions across the strands themselves further indicate pressure exerted and area of contact.

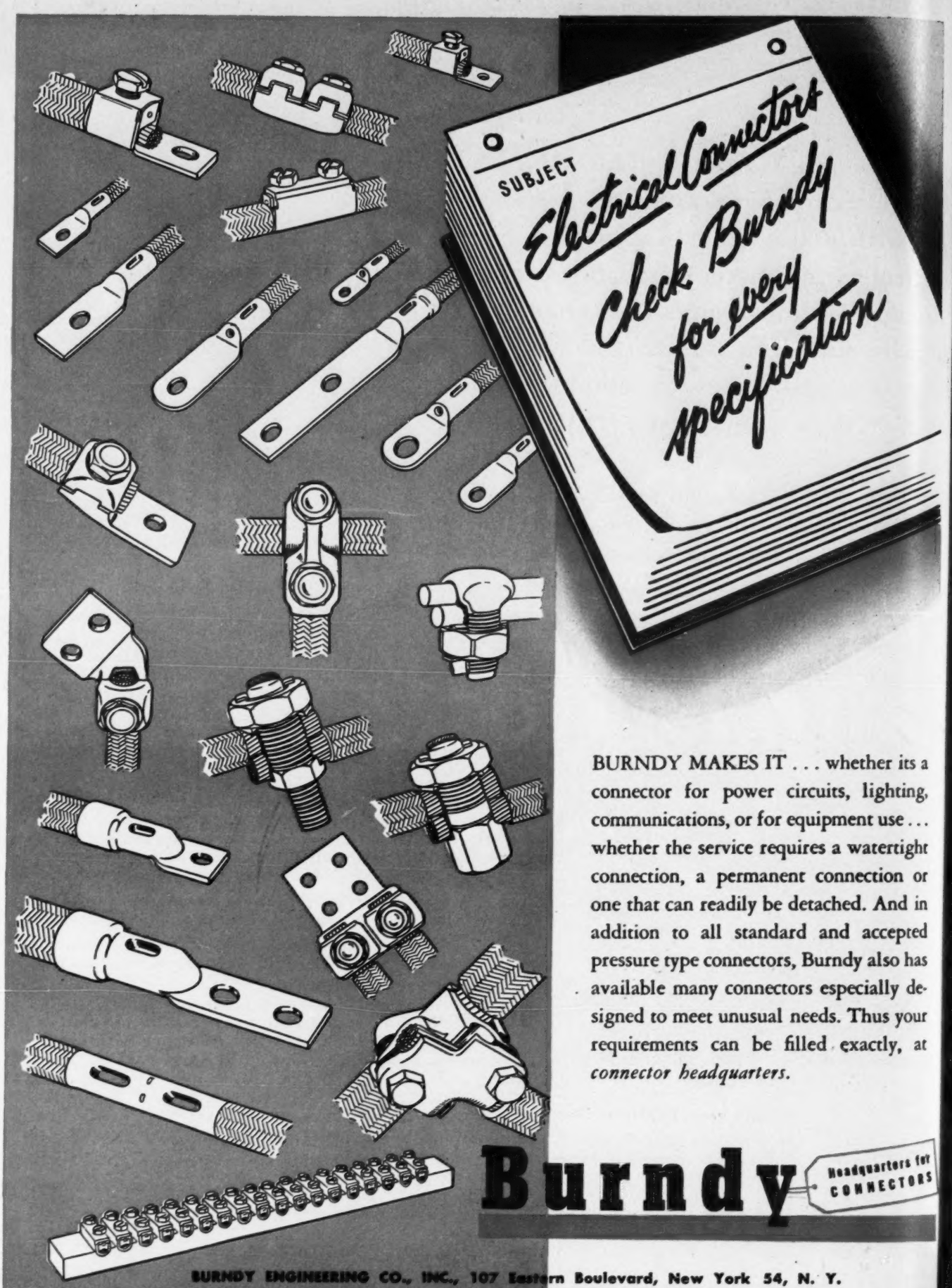
Corrosion and fatigue tests prove that the Sta-Kon connection is sound, both mechanically and electrically and that initial low resistance is unimpaired by age or service. Fully approved.

Phone your local distributor for samples of T&B Sta-Kons. All T&B products are sold exclusively through him. He reduces the manufacturer's selling cost thereby reducing the cost of all electrical material to the user.

Write for Bulletin 500 for information on the complete Sta-Kon line.

atented. Sta-Kon Reg. U.S. Pat. Off.

THE THOMAS & BETTS CO.
INCORPORATED
manufacturers of electrical fittings since 1899
ELIZABETH 1, NEW JERSEY
In Canada: Thomas & Betts Ltd. Montreal

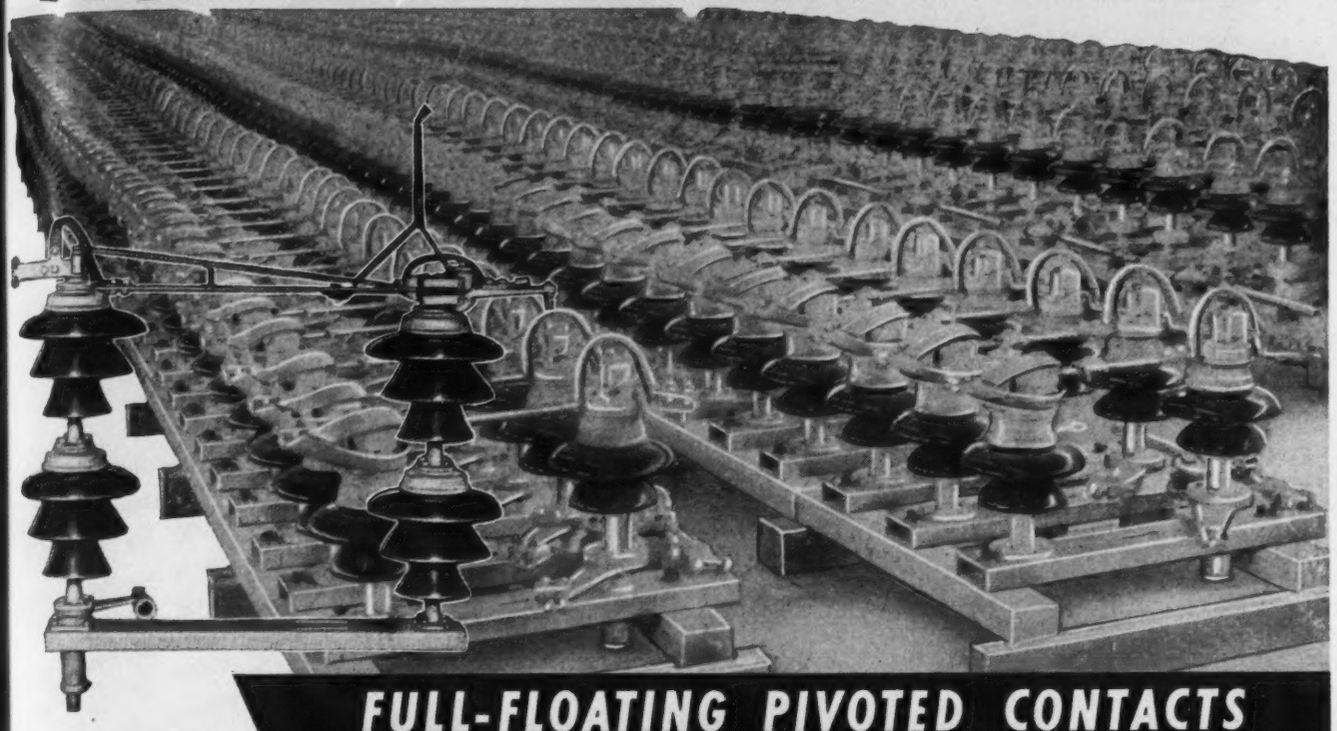


BURNDY MAKES IT . . . whether its a connector for power circuits, lighting, communications, or for equipment use . . . whether the service requires a watertight connection, a permanent connection or one that can readily be detached. And in addition to all standard and accepted pressure type connectors, Burndy also has available many connectors especially designed to meet unusual needs. Thus your requirements can be filled exactly, at *connector headquarters.*

Burndy Headquarters for CONNECTORS

BURNDY ENGINEERING CO., INC., 107 Eastern Boulevard, New York 54, N. Y.
IN CANADA: Canadian Line Materials, Limited, Toronto 13

"THREE E" TYPE 6600 ALL PURPOSE HIGH VOLTAGE SWITCH..



Single pole of 69 K.V. 600 ampere "6600-U" type switch.

FULL-FLOATING PIVOTED CONTACTS PERMIT OF EASY OPERATION UNDER ALL CONDITIONS

Above: Portion of large order of 400 ampere, 15 K.V. "6600-U" type switches being made ready for shipment.

THE "THREE E" 6600 Single Break Side Opening Airbreak Switch has two insulator stacks per pole. The rotating stack carries the blade and rotates to open or close the switch. The stationary stack carries the jaw contacts which are of the full floating, self-aligning, wiping, pivoted type enclosed in a sleet hood.

Any seal between the blade and contact shoes due to ice or corrosion is broken by shearing action of blades, allowing the switch to open easily. Contact surfaces are protected against dirt.

Connection from the shoes to the terminal blocks of the switch is made of flexible copper braid, tinned before braiding. The entire contact assembly is pivoted and free to move through a small arc of a circle.

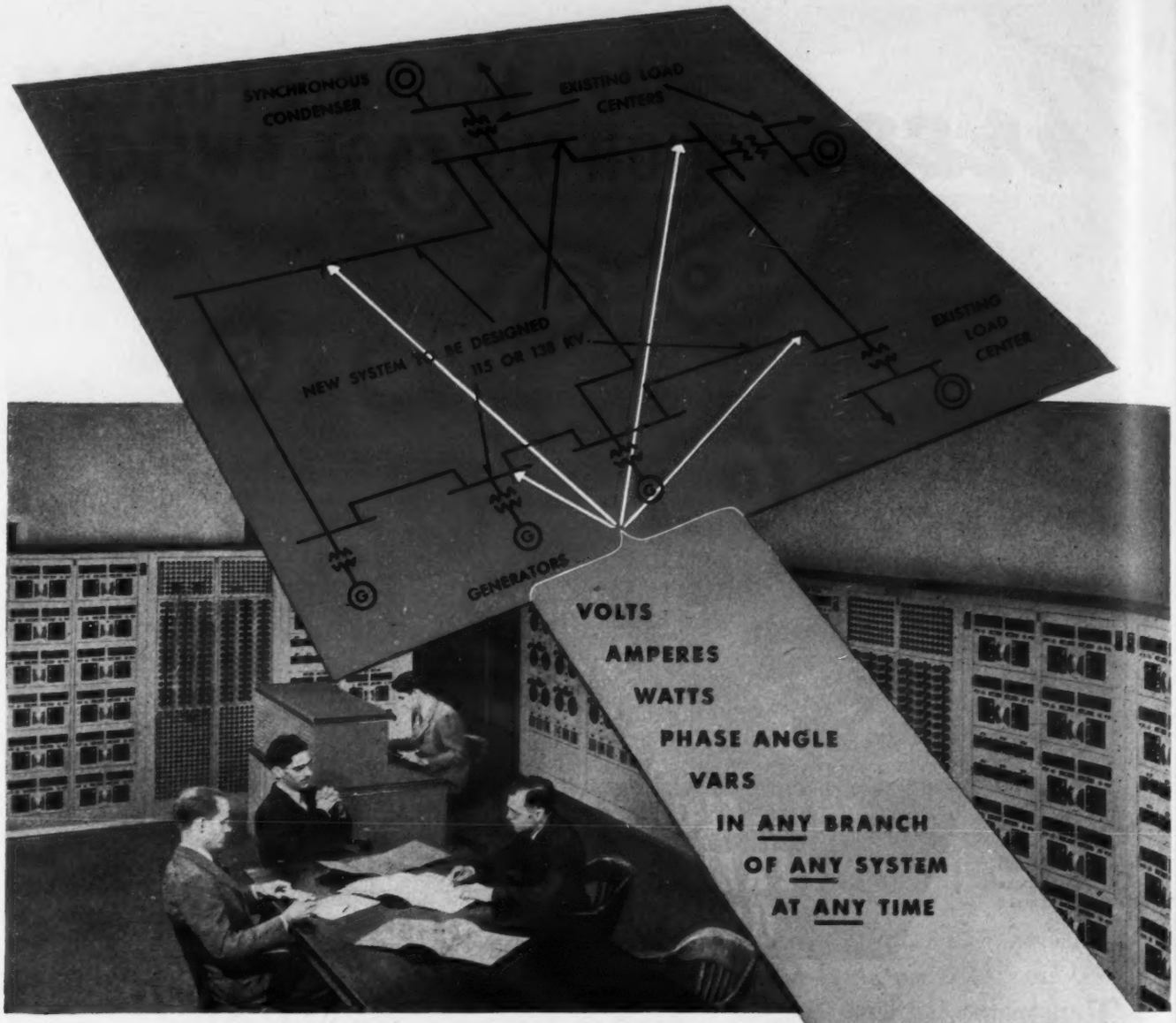
Switch is equipped with arcing horns made of Everdur metal and are so formed that when the switch starts to open a locking action occurs at the tip of the horns. As the switch moves toward the open position, this locking action is finally overcome and, due to the spring in the Everdur materials when stressed, the arcing horns snap away from each other with great rapidity. The arc is broken at the very tip of the horns as far above the ground as it is possible.

This type switch serves efficiently as a substation switch—a line sectionalizing switch—an oil circuit breaker disconnect—a by-pass switch.

Built for all voltages 7.5 to 161 kilovolts.

Bulletin 325 gives complete specifications—shows interchangeable feature for upright and underhung mounting—has chart giving complete ratings and dimensions—illustrates progressive movement of the blade—features important construction details. Write for a copy.

THREE E — ELECTRICAL ENGINEERS EQUIPMENT CO. — MELROSE PARK, ILLINOIS



NEW A-C NETWORK CALCULATOR "TELLS ALL"

. . . SOLVES TODAY'S OPERATING PROBLEMS . . . PLANS TOMORROW'S CHANGES

Largest and most useful A-C Network Calculator in existence is this new board now in service at East Pittsburgh, Pa. This new calculator incorporates all the advances made since installation of the first board in 1929. It enables setting up 50% more generator circuits and permits simultaneous study of *two* parts of the same system . . . thus greatly increasing speed of operation.

It is saving thousands of man-hours for utilities faced with finding quick answers to problems arising in connection with the utilization of present equipment to its fullest capacity, system stability studies, safe tie-line capacities and similar network problems.

The calculator also is playing an important part in postwar planning of system changes . . . it *"tells all"*, even before the system is built.

The advantages of the calculator are such that larger utilities have been acquiring similar calculators for their own use. Of eight such calculators now owned by utilities, six have been built by Westinghouse.

For more information, call your Westinghouse office or write for B-3313. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-60547

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

A-C NETWORK CALCULATOR

Here's another ad in the series that brings a vital message to your customers

How many "VICTORY" JOBS will result from

increased use of *Electric Energy*

It's an exciting postwar picture any way you figure it. Expanded use of electricity is one of the brightest fields to count on for jobs for our returning service men.

Think of the employment that will result from electronics alone, which includes radio, television and countless industrial and home applications. Or consider air conditioning, heating, cooking, lighting, refrigeration. As new and finer electrical products are developed, employment all along the line will be created . . . within the electrical industry, and in every other industry.

But one thing is self-evident. Wiring will have to come first. Adequate wiring will be essential to full utilization of the electrical possibilities of the future. Now—in advance—is the time to plan for it. By all means, give it full weight in your postwar thinking.

Unwired planning will cost you a whole lot more than *planned wiring!* 44223

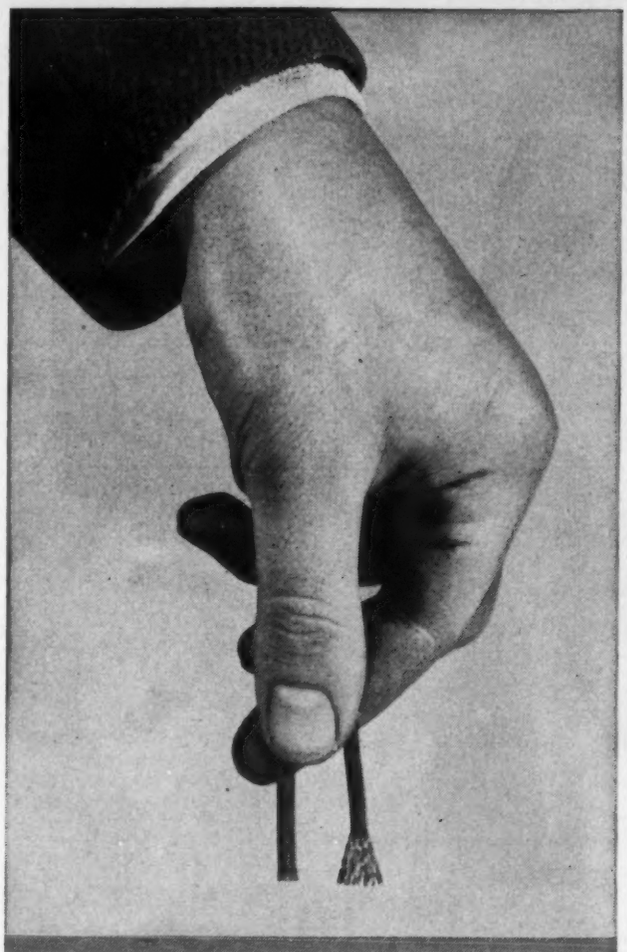
ADEQUATE WIRING SERVES AND SAVES — KEY TO VICTORY JOBS

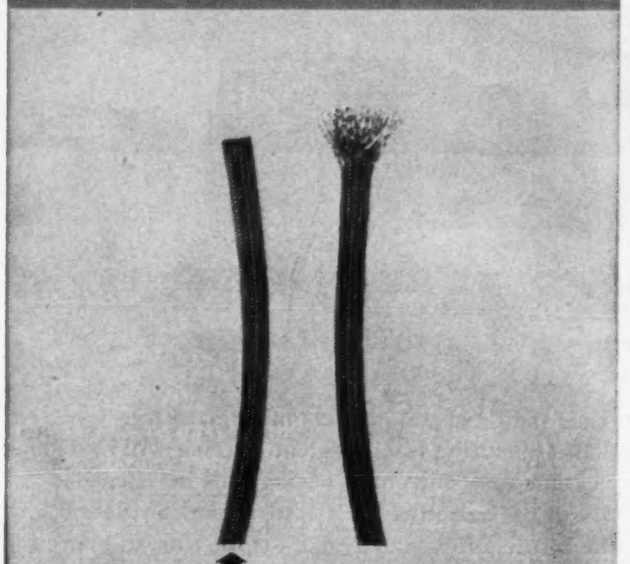
HELP BRING VICTORY SOONER . . . BUY MORE WAR BONDS.

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

Electrical Wires and Cables of Copper are the Life Lines of our Nation





THIS—NOT THIS

SNUB TEST

Proves non-fray feature of new BH Fiberglas Sleeving

NEW, BH Extra Flexible Fiberglas Sleeving *will not fray*, even under severe conditions. You can prove this *right at your desk*. It's easy as snubbing out a cigarette. Here's how:

Write us for a sample of BH Extra Flexible Fiberglas Sleeving equal in size to the saturated sleeving you use now.

Hold short pieces of both BH Fiberglas Sleeving and the usual saturated sleeving between your thumb and index finger, and snub the ends of both sleevings against your desk, similar to the way you would snub out a cigarette. Do this five to ten times, pressing hard.

BH Flexible Fiberglas Sleeving will spread slightly under this pressure, may fuzz a little, but *will not fray*. The usual saturated sleeving will break down at the edges and separate.

Continued snubbing will not noticeably affect the BH Extra Flexible Fiberglas Sleeving, whereas the saturated sleeving will readily unravel and become progressively worse.

NON-FRAYING • FLEXIBLE • HEAT-RESISTANT
NON-INFLAMMABLE • WATER-RESISTANT
NON-CRYSTALLIZING at LOW TEMPERATURES

The new BH Extra Flexible Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

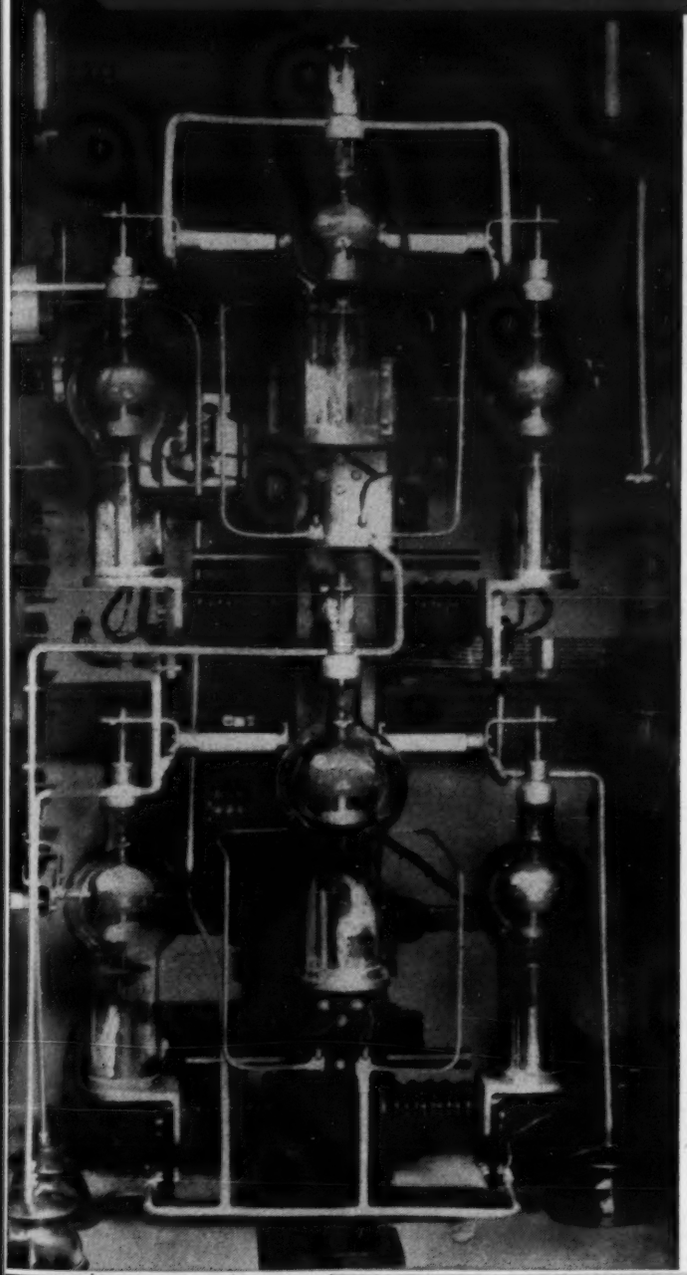
All sizes from No. 20 to 5/8", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. W, Conshohocken, Pa.

BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.
Conshohocken, Penna.

HOW TO MAKE SCARCE TIN GO THREE TIMES AS FAR!



WE'RE a "have not" nation when it comes to tin. That's why a new plating method—developed by Westinghouse—makes big news! High frequency induction heating is the answer, and it not only fuses a uniform, corrosion-resisting tin coat on sheet steel five times faster than previous methods—it also uses only one-third as much tin!

Unexpectedly, glass made by Corning plays an important part in this job. The picture at the left shows the key units creating the high-frequency, tin-smoothing waves. They are glass vacuum tubes about like you'd find in a radio station. Note, too, the glass bowl insulators handling the "juice." As an example of the type of service these glasses must give, one plant is installing tin-plating oscillator units with 72 times the power of the largest radio broadcasting station now on the air in the United States!

High electrical insulating qualities are just one of the interesting characteristics you can get in glass made under the Army-Navy "E" flag at Corning. There are glasses with an expansion coefficient practically equal to that of fused quartz; glasses that are extremely resistant to mechanical shock; glasses that can be made into intricate shapes formerly considered impossible. If you even suspect that glass may help solve one of your problems, we want you to know that Corning's "know-how" is at your service. A study called "There Will Be More Glass Parts In Post-War Electrical Parts" will help bring you up-to-the-minute. Won't you write for a copy? Address the Electronic Sales Department W-4, Bulb and Tubing Division, Corning Glass Works, Corning, N.Y.

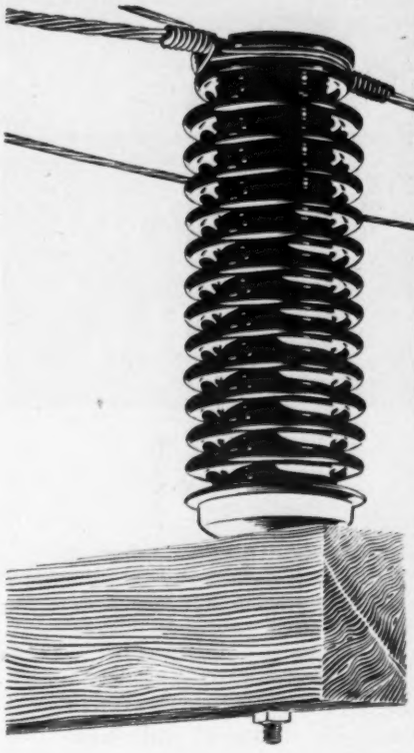
Photo Courtesy of Westinghouse

CORNING *means* Research in Glass

Electronic Glassware

T.M.REG. CORNING U.S. PAT. OFF. T.M.REG. PYREX U.S. PAT. OFF.

"PYREX" and "CORNING" are registered trade-marks of Corning Glass Works

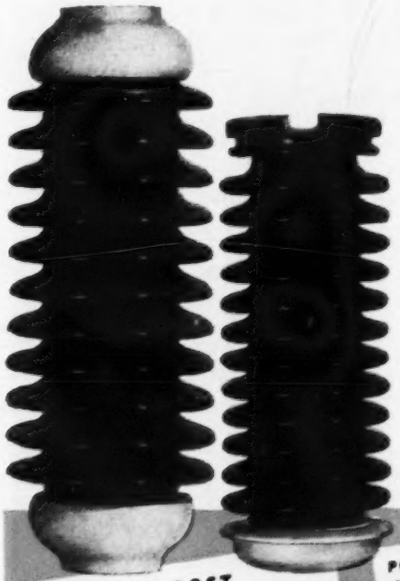


WARTIME CONSTRUCTION

need not be "TEMPORARY CONSTRUCTION"

TRANSMISSION LINES ON WOOD POLES AND LAPP LINE POSTS ARE LONG-LIFE, LOW-TROUBLE LINES . . . . . THAT GO UP FAST AND USE A MINIMUM OF MATERIAL

• On a cost-per-year basis, transmission line construction on wood poles with Lapp Line Posts is most practical and economical. And today, if load demands make it necessary for you to build a new line under war-emergency restrictions, you'll find this same construction will require least in critical materials, least in man power. The extra height of Lapp Line Posts will give your line better clearance, or even in some cases permit use of shorter poles. Coordinate necessity measures with your long-time planning and build low-cost long-service lines—on Lapp Line Posts.



LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

...from the COMPLETE LINE OF OLIVER LINE MATERIALS

OLIVER
Drive Head Ground Rods

AMPLE STRIKING SURFACE
TOP TINNED AFTER GALVANIZING
OLIVER
STIFF STEEL ROD ⅝" OR ¾" DIAMETER
NON-FERROUS CLAMP BOLT
LENGTHS ⅝"—5 to 10 FT. ¾"—6 to 12 FT.
HOT DIP GALVANIZED
FORGED POINT

The combination Ground Rod and Clamp shown here offers many time- and money-saving features based upon our extensive experience in the design and manufacture of grounding materials.

The enlarged head provides ample striking surface for fast driving, even under conditions of hard ground. The forged point also assists easy penetration. The top is tinned after galvanizing for extra protection.

The forged clamp (also tinned) and non-ferrous clamp bolt assist in making connections and insure a permanent, trouble-free job.

Made in sizes and lengths shown.

OTHER OLIVER GROUNDING MATERIALS

The Oliver Line has everything needed for grounding, including ground rods wired and unwired and pipes of various lengths, clamps of all types and sizes, caps and points for use with standard pipes, bayonets, wood moulding, staples and other accessories. Regularly furnished hot dip galvanized, also available in Copperweld steel.

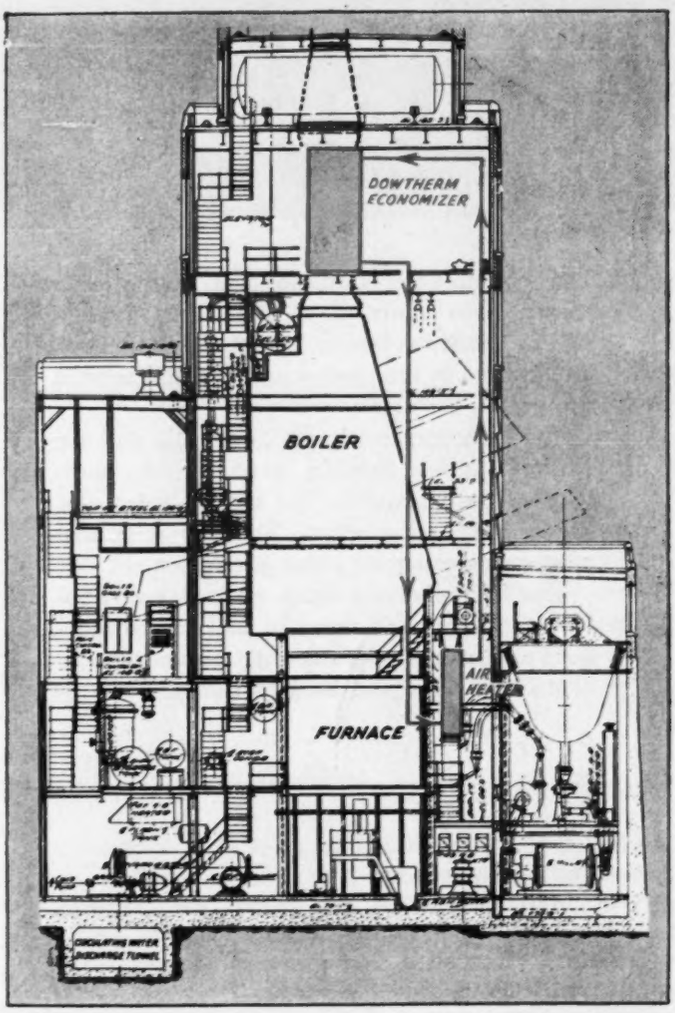
See the 1944 Oliver catalog for complete details.

OLIVER IRON AND STEEL Corporation

SOUTH TENTH AND MURIEL STREETS · PITTSBURGH, PENNSYLVANIA

Blazing THE

DOWTHERM ECONOMIZER FOR AIR-PREHEATING



• Complete elimination of large preheater air ducts extending from above the boiler to the firing floor, 100 feet below, has been effected at the Bremo Station of the Virginia Public Service Company. The customary air heater, located over the boiler, was replaced by an economizer heating Dowtherm (not water) to 500°F. The hot Dowtherm is pumped down through small diameter lines to the burners, where it is used as the heating medium in tubular air preheaters. Besides doing away with cumbersome ducts, this system reduces radiation losses and gives individual control of primary and secondary air temperatures.

Foster Wheeler is a Three-Star winner under the U. S. Navy Board of Awards for production

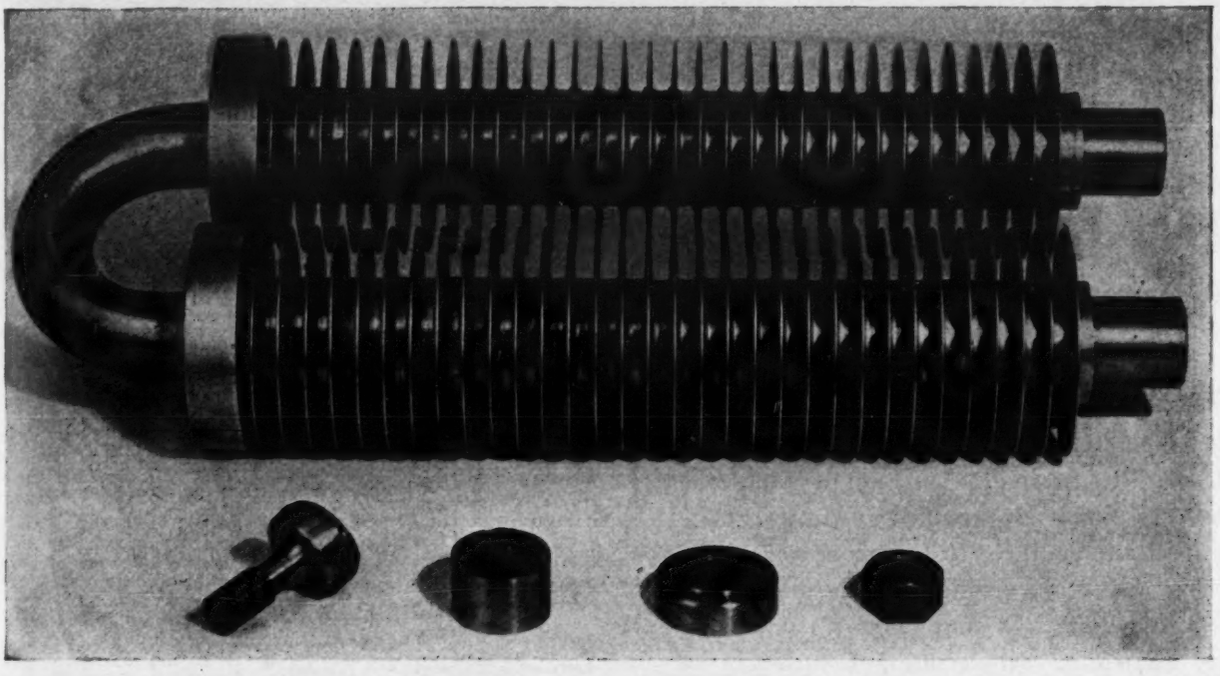
FW FOSTER

ENGINEERING TRAIL

ALUMINUM RING ECONOMIZERS

• Twenty-four years ago, Foster Wheeler designed and commercialized the cast iron extended surface ring economizer. Performance of this high efficiency unit made it a "natural" for marine service—but its weight proved prohibitive. Exhaustive research solved the problem and a comparable light weight aluminum ring design, suitable for high pressure, was developed for the U. S. Navy.

Nine times the surface of bare tubes per lineal foot, exceptional lightness, minimum space requirements and remarkably low maintenance caused its application to merchant ships as well. The aluminum ring economizer is the finest construction in marine engineering.

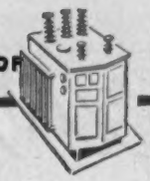


FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, N. Y.

WHEELER FW

AN OUTSTANDING WESTINGHOUSE CONTRIBUTION TO GREATER CONTINUITY OF POWER SERVICE



a "straight-jacket"

that tames high-current stresses

The terrific mechanical forces induced by a short circuit tends to distort and crush the coils in a power transformer. Westinghouse engineers use the shell-form core to reduce these stresses. It surrounds the coils like a steel "straight jacket".

Coupled with such Westinghouse developments as *Hipersil**, loading-by-copper-temperature, forced-air and forced-oil cooling, the shell-form design permits high-capacity power transformers to be made smaller, lighter, and shaped to fit into any installation.

A recent example is the transformer illustrated at right. It effected a saving of 38 tons of critical materials, and fits under an existing superstructure. Shipped filled with oil, it was ready to operate immediately.

Westinghouse makes *both* core-form and shell-form transformers and applies the *correct* design for any specified application. The application of the shell-form core *where it is best applied* is a distinct contribution to service reliability and continuity. Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa. J-97086

**Registered Trade-Mark, Westinghouse Electric & Manufacturing Company for HIgh PERmeability SILicon steel.*

Westinghouse

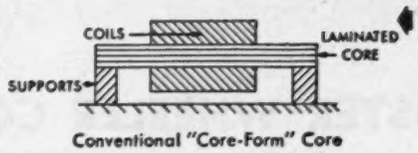
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

CENTRAL STATION EQUIPMENT

THE SHELL-FORM CORE MADE THIS TRANSFORMER POSSIBLE!

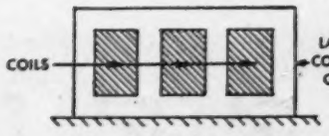
J. K. Hodnette, Manager of the Westinghouse Transformer Engineering Department, beside the 40,000 kv-a, 138 kv horizontally-mounted transformer built for a Midwestern power company.

The horizontal shell-form transformer, an exclusive Westinghouse development, ideally met the stringent requirements of this application. Diagrams below, show the basic advantages of the shell-form core.



Conventional "Core-Form" Core

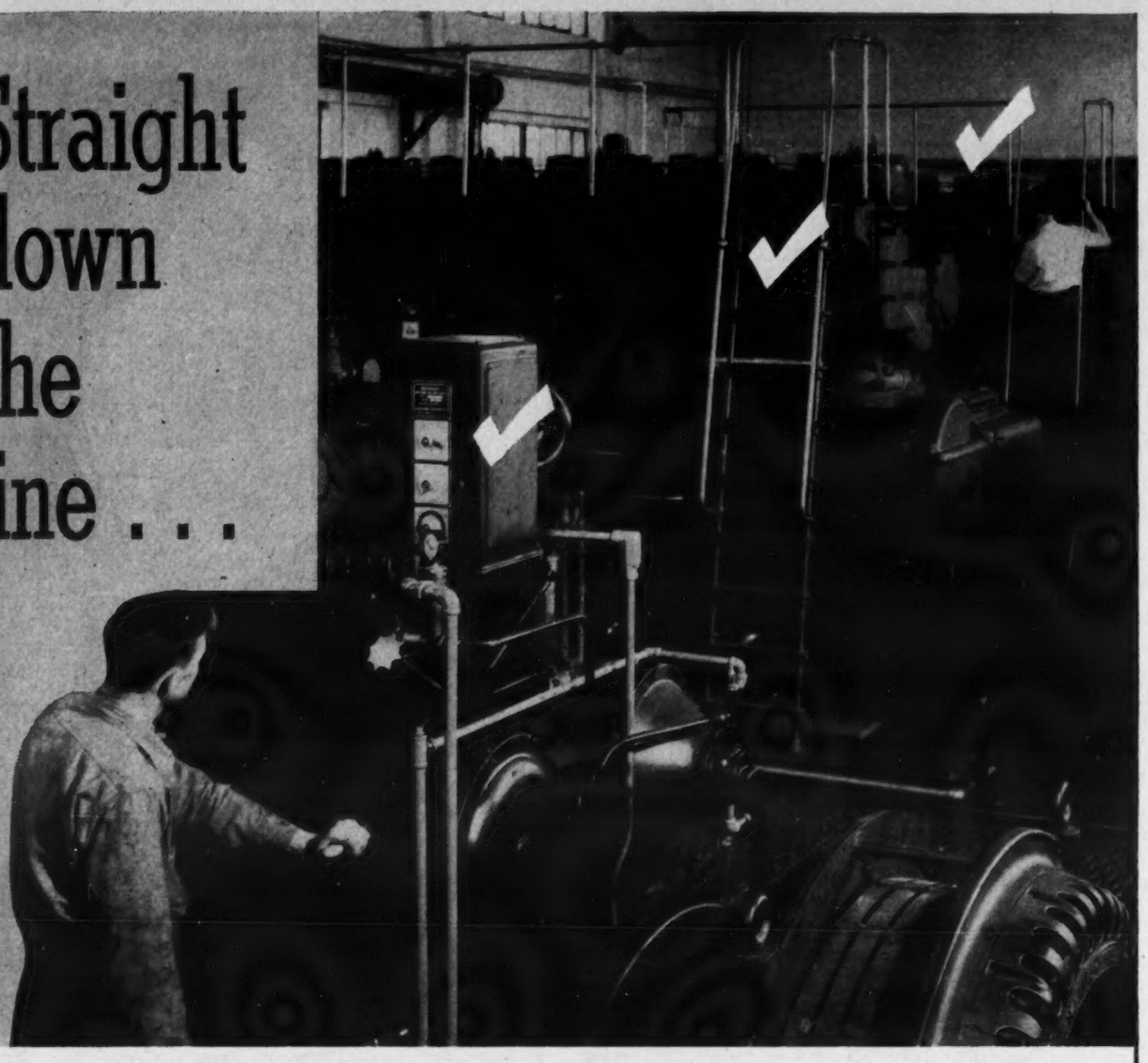
Coils wrap *around* the *core*. Horizontal mounting is impractical.



Shell-Form Core

Core wraps *around* the *coils* like a steel "straight jacket". Coils are firmly anchored against movement during extra-heavy current surges. Mounted vertically or horizontally with equal effectiveness. Furnished by Westinghouse for heavy-duty high-voltage power transformers.

Straight down the line . . .



GULF PARVIS OILS

reduce maintenance costs and insure maximum efficiency

To help keep your Diesels continuously in service and operating at peak efficiency, take a tip from scores of power plants that report definitely improved lubrication with Gulf Parvis Oils.

These higher quality Diesel lubricants provide an extra margin of protection to vital parts — help prevent excessive wear that leads to shutdowns and high maintenance costs. And here's another important plus value you get when you use Gulf Parvis Oils: the helpful counsel of Gulf Service Engineers, *specialists in scientific Diesel lubrication.*

Make sure your Diesels are getting the kind of lubrication that insures uninterrupted power output and maintenance economies. Write, wire, or phone your nearest Gulf office today and ask a Gulf Lubrication Service Engineer to call.

GULF INDUSTRIAL LUBRICATION

Back the attack . . buy more War Bonds

GULF OIL CORPORATION · GULF REFINING COMPANY · Gulf Building, Pittsburgh 30, Pa.

you can't teach an old dog new tricks

That's a proverb that is all wrong. We are doing new things with mica every day. Shaping and forming to precision standards. Whatever can be done with Mica we can do . . . new tricks too.

When you think of MICA think of MACALLEN

the Macallen Company

16 MACALLEN STREET - BOSTON 27

CHICAGO: 545 W. Washington Blvd. CLEVELAND: 1006 Leader Bldg.

NEW O. Z. FITTINGS

that fit into

PRACTICAL PLANS

Tested in the crucible of wartime service, these 11 additions to more than 160 O. Z. electrical fittings are ready to serve Practical Planners who recognize skilled engineering, modern manufacturing, and select materials. 25 years of close association with the electrical industries assures their use of O. Z. products.

INSULATED BUSHING FOR E.M.T.

An added bushing adapted for use with thin wall conduit (E.M.T.). Made of malleable iron with case-hardened cup point set screws. Insulation is molded and locked into the casting.

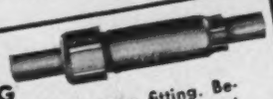
GROUNDING NIPPLE

A corrosion-resistant fitting with mechanical connection which is particularly adaptable for joining a ground wire to a conduit or a bank of conduits, and for other grounding purposes.

EXPANSION FITTING

A new, short, compact expansion fitting that compensates for expansion and contraction in a line of conduit. Composed of fewer parts, it takes a minimum of space and installation time.

THIN WALL EXPANSION FITTING

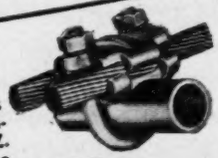


Incorporates all the features of the above fitting. Because of its special construction, the "TX" is supplied complete with extension nipples, ready to receive thin wall couplings.

T-CONNECTOR

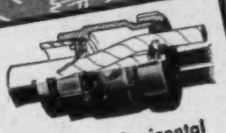
A compact flexible fitting with two or three wire branch taps. O. Z. Interlocking Clamp insures positive gripping of wires. Of high copper alloy for full conductivity and corrosion-resistance.

GROUND CONNECTORS



The new Interlocking Clamp has been incorporated in the completely redesigned line of O. Z. Grounding Devices. This feature confines the strands within the pressure area.

NEW HORIZONTAL TERMINATORS

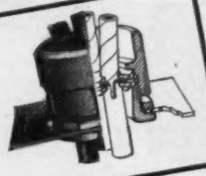


All the features of the O. Z. Terminating Potheads are embodied in these Terminators, intended for use on conduit in inverted or horizontal installations.

NEW "J" TERMINATOR

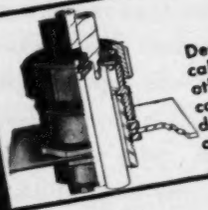
Incorporates the general principles of O. Z. Terminators, with the addition of a collapsible feature, making an easily installed device for terminating and sealing or as a pulling and splicing chamber.

COMPOUND BUSHING



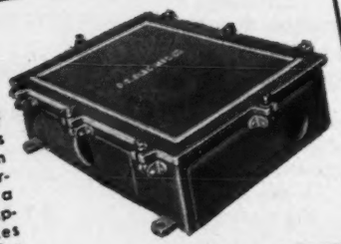
A compact sealing device used in locations where space is limited. This fitting is not equipped with a cover, and a small reservoir is provided for compound.

SEALING BUSHING



Developed to terminate and seal cables in cabinets, control boxes and other junction positions. Having no compound chamber its height is reduced allowing maximum space for other equipment.

NEW JUNCTION BOX LINE



A complete line of cast iron boxes has been designed in both flush and surface types for a wide variety of applications. Boxes of any type or size readily supplied.

New 144 page, fact packed O. Z. Catalog covers the complete line of O. Z. products. Price lists, engineering data, and dimensions on **Conduit Fittings • Cable Terminators Junction Boxes • Solderless Connectors • Power Connectors • Grounding Devices.** *Write for your free copy.*

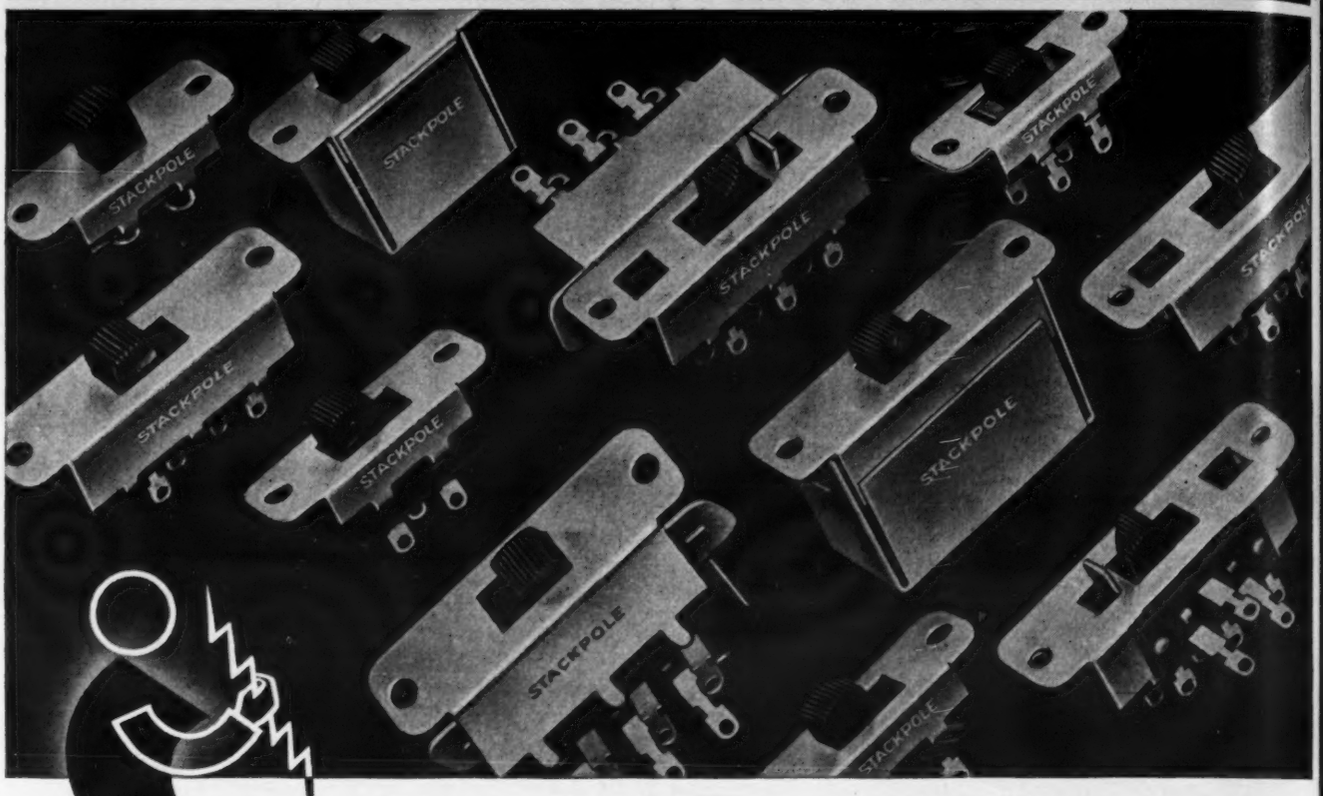
5617

O. Z. ELECTRICAL MFG. CO.

262 BOND STREET • BROOKLYN 2, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

SWITCHES LINE · SLIDE ROTARY-ACTION



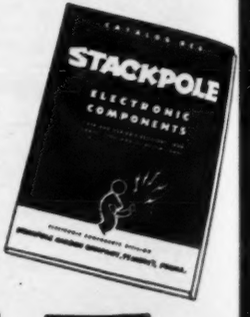
...cheap...dependable...adaptable

From radio equipment to toys (post war, of course), from instruments to all sorts of electrical appliances, Stackpole Switches afford a broad engineering selection. Units are compact, dependable, low in price, and are subject to countless adaptations to meet the specific requirements of quantity users.

Standard types include line, slide, and rotary-action styles; 3-position types; and 1-, 2-, 3-, and 4-pole switches with or without spring return, detent, covers, and other optional features. Nine or more possible uses for Stackpole Switches on a single table model radio offer convincing evidence of the scope and versatility of the line. Write for catalog.

What do you need in MOLDED CARBONS, GRAPHITES, METALS & COMPOSITIONS?

Electrical Brushes and Contacts
Bearings — Anodes Electrodes
Powder Metallurgy Components
Welding Rods — Pipe Brazing Blocks
Packing, Piston, and Seal Rings
Rheostat Plates and Discs
Carbon Discs for Regulators, etc.



***New!* Electronic Components Catalog on Request ▶**

In addition to complete details on Stackpole Switches, Fixed and Variable Resistors, and Iron Cores, this new 36-page catalog contains much helpful data for purchasing agents, engineers, and production managers. Write for your copy today.

STACKPOLE CARBON CO., ST. MARYS, PA.

STACKPOLE

MOLDED METAL POWDER AND CARBON PRODUCTS

Official U. S. Marine Corps Photo

...and we won't be back 'TILL IT'S OVER OVER THERE!

TAKE CARE OF THESE VETERANS!

FWDs are "veterans" in all the "groundwork" of industry and warfare. Treat them right and they will continue to serve well. Wherever FWD trucks are serving on industry's "transportation front," keep them on the job by taking good care of them. They deliver years of heavy-duty service if periodic inspection and maintenance are not neglected.

● UP FRONT on all fronts, FWDs are "in to the limit" in this Global War, as they were in World War I . . . and they are again proving the merit of four-wheel-drive "going power".

Landings, like the one shown here... with a Marine FWD leaving the open prow of an "LST" tank landing ship, and moving up the beach of a South Pacific island...are "just one of those things" for these sure-footed four-wheel-drive trucks that "get down on all fours" and pull or push through to their objectives, as only FWDs can! They are in on many other heroic ventures...slashing through jungles, clearing away obstructions, establishing beachheads, building bridges, roads, airports ... hauling all the materiel of war to fighting men.

Not only on fighting fronts, but also all across the hard working war-production and transportation front, on 24-hour-a-day, 7-days-a-week schedules, FWDs are proving they have what it takes to meet every trucking demand.

SEE YOUR NEAREST FWD BRANCH or DEALER — Call the nearest FWD factory branch, district serviceman or dealer, regularly, for sound maintenance advice and skilled service.

THE FOUR WHEEL DRIVE AUTO COMPANY, Clintonville, Wisconsin

Canadian Factory: KITCHENER, ONTARIO

SERVING ON FIGHTING FRONTS and INDUSTRY'S WORK-FRONTS... WHEREVER HEAVY-DUTY TRUCK QUALITY IS PUT TO THE TEST, FWDs DELIVER!

COMMERCIAL

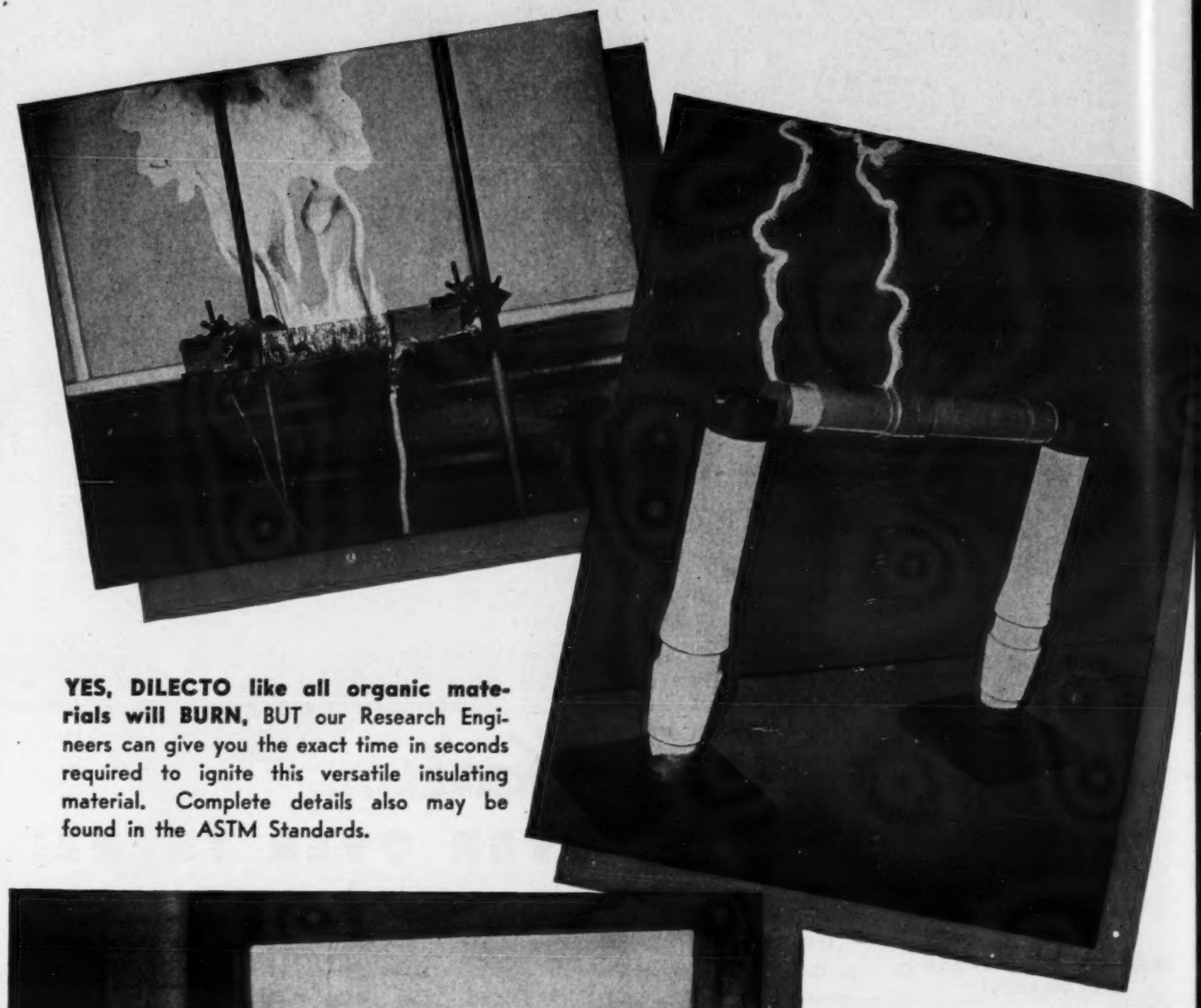
CONSTRUCTION

UTILITIES

OIL FIELDS

MILITARY

. . . C-D's CUSTOMERS



YES, DILECTO like all organic materials will BURN, BUT our Research Engineers can give you the exact time in seconds required to ignite this versatile insulating material. Complete details also may be found in the ASTM Standards.

DESIGNED for 15 KV . . . REQUIRES 52 KV to CAUSE FLASHOVER. Shown above is a Dilecto Oil Circuit Breaker Bushing for indoor use. While intended for a breaker of 15 KV, 1200 Amp. rating, specifications called for no flashover between mounting collar and terminals at a voltage under 50 KV. C-D Engineers made certain it took 52 KV to cause flashover.

At left is a precision instrument for measuring the power factor and dielectric constant of solid dielectrics. Every grade and thickness of Dilecto gets a control check on this device.

GET THE ANSWERS

In one of America's most complete research laboratories a staff of specialists in both electrical and physical insulation devote their skills to finding out "What happens?". Their reports and recommendations are passed on to manufacturers so that they can accurately predetermine the performance of their products, enabling them to save time and money, and build prestige.

Continental-Diamond's engineers are working now on "The Shapes of Things to Come". If you are planning on product improvements that might be speeded by the use of a C-D NONmetallic we suggest that this is the time to avail yourself of C-D facilities and experience.

C-D PRODUCTS

DILECTO A laminated plastic. High in electrical insulating properties. Of great structural strength. Resistant to moisture to a high degree. Readily fabricated to special shapes from basic standard forms of sheets, rods and tubes.

DIAMOND VULCANIZED FIBRE is a hard, dense, bone-like material . . . tough, pliable and strong. It is light in weight yet mechanically strong and will not deteriorate under constant mechanical strain.

MICABOND Here is mica in its most usable form. The high heat resistance of mica and its high dielectric strength are almost completely preserved in MICABOND plate, flexible sheets, tape, tubing and punched and formed parts.

VULCOID A product of Continental-Diamond's manufacturing experience and laboratory research. A material that offers a combination of the properties of Dilecto and Diamond Vulcanized Fibre.

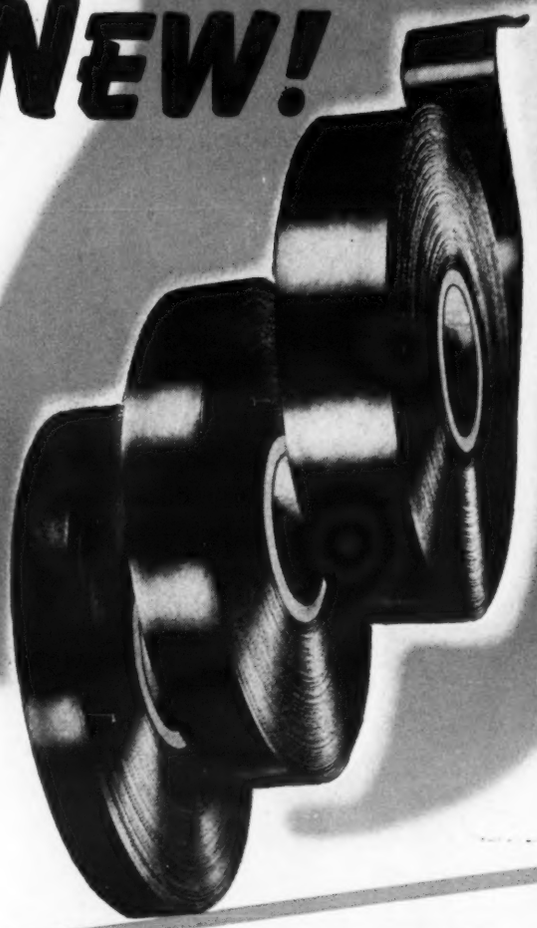
CELORON A molded mascerated fabric base plastic that is also readily machined. CELORON combines to a high degree the desirable properties of impact strength, tensile strength, dielectric strength, moisture resistance, heat resistance and dimensional stability.

The above photograph shows a conventional hat molding press being used for experimental molding of laminated materials, at low pressure. The part which has just been removed from the mold is a low pressure phenolic laminated aircraft engine baffle.

Continental Diamond FIBRE COMPANY

Manufacturers of Laminated Plastics since 1911

NEW! Fibron THE "ALL-PURPOSE" TAPE



FOR INSULATING wires, cables and electrical equipment . . . **FOR PROTECTING** electrical wires and cables exposed to caustic or corrosive fumes, oil, grease, acids, alkalies, or moisture...**FOR SPLICING** cables with a continuous, protective covering . . . **FOR COVERING** exposed piping in chemical plants, equipment exposed to moisture or severe atmospheric conditions.

These widely diversified applications of FIBRON TAPE No. 1 are made possible by its combination of outstanding electrical, physical, and chemical properties. (See adjacent panel.) This *flexible, elastic,* "Vinylite"* resin tape is heat sealing, flame resistant, high in dielectric strength, strong mechanically, and highly resistant to oils, acids, alkalies, moisture, and normal variations in temperature and climate.

FIBRON TAPE is a new addition to the already extensive line of Irvington products. It is offered with the usual guarantee that applies to all Irvington Insulation — to protect equipment in accordance with specifications.

Plan now to test the new FIBRON TAPE. A generous sample will be sent on request — without obligation. For further information on FIBRON, or other IRVINGTON INSULATION, write Dept. 46.

*Reg. Trade Mark—CARBIDE & CARBON CHEMICALS CORP.

OUTSTANDING PROPERTIES
FIBRON TAPE No. 1

Tensile strength	1700 lb. per sq. in.
Dielectric strength	1000 VPM (.012")
Low temperature flexibility	—40° C.
Elongation	250% — 400%
Power Factor @ 30° C. (60 cycles)	—6.5%
(1 kilocycle)	—6.2%
Dielectric Constant @ 30° C. (60 cycles)	—7.6%
(1 kilocycle)	—6.9%
Bonding temperature	Approximately 150° C.

IRVINGTON for INSULATION

EXTRUDED PLASTIC TUBING
INSULATING VARNISHES
VARNISHED PAPER
VARNISHED CAMBRIC
VARNISHED CANVAS AND DUCK
VARNISHED TUBING
VARNISHED RAYON
VARNISHED FIBERGLASS
VARNISHED SLOT INSULATION
OIL STOPS
VARNISHED AND PLASTIC WIRE MARKERS

STANDARD OF THE WORLD IRVINGTON INSULATION TRADE MARK U.S. PAT. OFF.

IRVINGTON VARNISH & INSULATOR COMPANY
6 Argyle Terrace, Irvington 11, New Jersey, U. S. A.
Plants at
Irvington, New Jersey and Hamilton, Ontario, Canada
Representatives in 20 Principal Cities

5582

IRVINGTON *Electrical* INSULATION

PLUG IN ANYWHERE ALONG THE LINE —WITH BULLDOG BUSTRIBUTION DUCT

This photo shows BullDog Bus Duct used on welder circuits. Note the short cable runs from overhead Plugs.

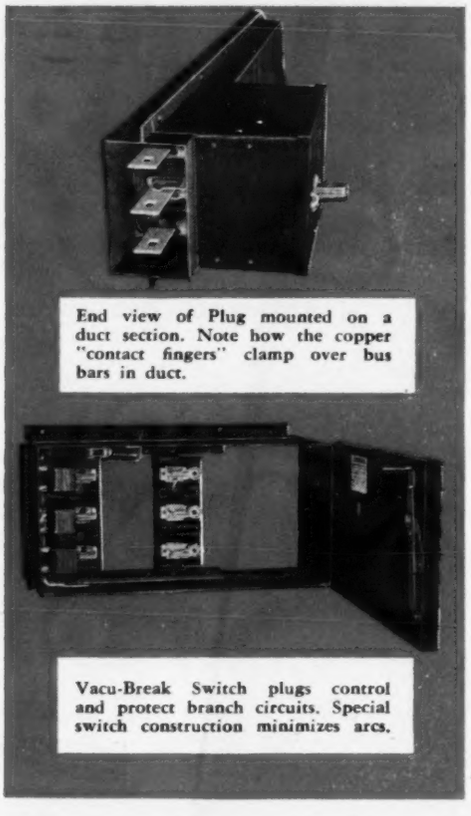
When you install Bus Duct, you wipe out a great many of your electrical power problems.

You can add new machines at will or move old ones to any location because ten plug-in openings are available in each standard 10-foot section of safely-enclosed duct casing.

This gives your workers a constant flexible source of power that is safe . . . convenient . . . clean . . . efficient.

Also, Bus Duct can be easily and quickly installed. Any plant electrician with a couple of helpers can put it up. And it is 100% salvable.

Those plants which have Bus Duct will be a long step ahead in reconverting to peace production. Our field engineers will be happy to help you with *your* power problems. Write today for complete descriptive Bulletin No. 427.



End view of Plug mounted on a duct section. Note how the copper "contact fingers" clamp over bus bars in duct.

Vacu-Break Switch plugs control and protect branch circuits. Special switch construction minimizes arcs.

Buy More War Bonds
Get In Your Scrap

BULLDOG
ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ont.

Field Engineering Offices in All Principal Cities

ALSO MANUFACTURERS OF

VACU-BREAK SAFETY SWITCHES • SAFTOFUSE PANELBOARDS • SWITCHBOARDS • CIRCUIT MASTER BREAKERS • UNIVERSAL TROL-E-DUCT, *for flexible lighting* • INDUSTRIAL TROL-E-DUCT, *for movable "loads."*

New War-Service Advertising Campaign

To a man's heart through his Hide

HE'LL GET A SINGING GLOW FROM BATH TOWELS GIVEN THIS EXPERT CARE!

Wash in HOT, softened water—120° to 130° or as hot as hands can stand. Use plenty of suds.

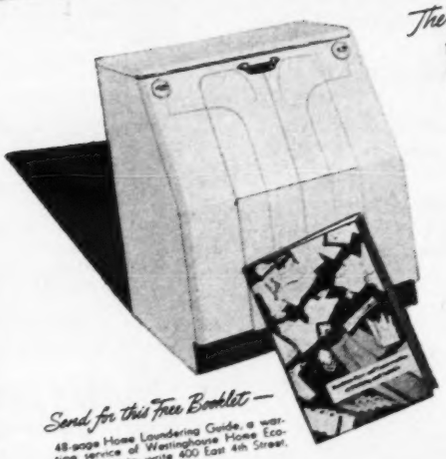
Wring towels into hot, agitated rinse of clear, softened water; swish them very thoroughly.

If towels are grimy or greasy, use a good bleach according to the directions on the label.

Repeat rinse until water is clear. Soap residue left in your towels causes dingy grayness.

Wring towels, shake vigorously for drying. When dry, shake out and fold without ironing.

Diapers take same treatment, with sterilizing in boiling suds, or bleach, plus extra rinses.



There'll come a day when washing towels will be simplified to "put 'em in—set the dials—take 'em out!" They'll come out gay and luxurious, made soft and fresh by the Westinghouse Laundromat.

This postwar appliance, already tested in twenty-five thousand homes, has proved that it can make dreams come true. Its operation is completely *automatic*—*it fills itself with water, washes, rinses, spins amazingly dry, shuts itself off.*

Yes, the day will come when Westinghouse, maker of 30,000,000 worthy appliances, will give you this entirely new and patented method of home laundering. That is why the Laundromat is worth waiting and saving for. Buy War Bonds.

Westinghouse *Laundromat*

Offices Everywhere

Plants in 25 Cities . . .

Tune in on John Charles Thomas, Westinghouse Program, NBC, Sunday, 2:30 P. M., E.W.T.

Send for this Free Booklet—

48-page Home Laundering Guide, a wartime service of Westinghouse Home Economics Institute, write 400 East 4th Street, Mansfield, Ohio.

Perhaps we're biased! But we believe this major advertising campaign, **TO START IMMEDIATELY**, on the Westinghouse automatic washer—the Laundromat—is the season's biggest news in the appliance industry.

The Laundromat is typical of the kind of postwar electric appliances Westinghouse will offer. It's a revolutionary product—patented in its method of operation—daring in design—outstanding in efficiency. ***But it's far past the blueprint stage.*** It has already *proved* it can make dreams come true—for today 25,000 Laundromats are operating in American homes in just a few territories, and all sold before Pearl Harbor.

You've wanted dope on postwar plans. The public wants information on postwar products. So we believe this is the time to release ***dramatically*** some news of what consumers can expect in the postwar world . . . not the day the war ends, but in the years that follow.

There is another big reason for this Laundromat campaign. Notice the ad closely. It helps on a much-needed wartime job that Uncle Sam wants done—the conservation of clothes and textiles. So each Laundromat ad gives laundering information on specific clothing or textile articles—rayons, colored clothes, men's shirts, slip covers, curtains, and others. This advertising not only gives postwar news but advice that's needed right now.

Starting on April 7, ads like the one shown here will appear in 4 colors in top-flight magazines. Laundromat "commercials" will be on the air in our "Top of the Evening" Blue Network radio program. And, further news of this new Westinghouse promotion will be released early in May.

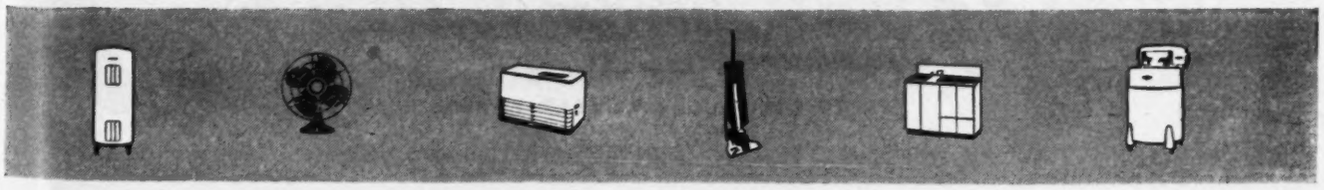
BETTER CARE LESS REPAIR

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

ELECTRIC HOME APPLIANCES

WESTINGHOUSE PRESENTS: *John Charles Thomas, NBC Network, Sunday, 2:30 P.M., E.W.T.*
"Top of the Evening", Blue Network, Mon., Wed., Fri., 10:15 P.M., E.W.T.



THEY ALL SAY "TAPE" ON THE BOX....

SAYS TAPE ON THE JOB!

How can you tell the difference . . . how can you always be sure of the highest quality tape without experimenting around?

The answer is easy: Ask for *Gold Seal* – by name – every time you order tape. You'll get greater tackiness that gives a firmer, longer-lasting bond. Higher tensile and insulating strength. A non-raveling tape that doesn't "peel" or dry out. You'll find Gold Seal uniform all the way from the first strip off the roll to the last!

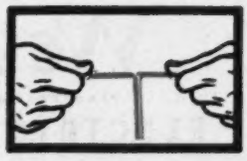
Try Jenkins *Gold Seal* tape on your next tough job. Convince yourself that there's as much difference between tape as between other materials and tools of your business! Jenkins Bros., (Rubber Division), 80 White Street, New York 13, N. Y.

Other Jenkins Bros. tape products include Diamond Seal Friction Tape, and Diamond Seal Rubber Tape, which meet ASTM and Federal specifications.

Convince yourself

MAKE THIS EASY TEST!

1 Tear two 6 inch strips from a roll of *Gold Seal* tape and stick faces together. Do not apply pressure.



2 Pull the strips apart slowly, forming a "T". Feel what a stiff pull this takes. Note long adhesion "teeth" at point of separation.

JENKINS *Gold Seal Tapes*

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

A WASTEFUL BROADSIDE *from your company*

CAN CRIMP A NAVY BROADSIDE

Against the Japs

YOU BET IT CAN. For the ammunition which our fleet fires reaches its destination protected by paper. And the paper you waste in an ornate, unnecessarily large advertising broadside is just what the Navy and the Army need to do their job.

That's why Uncle Sam asks you to watch every company project in terms of USING LESS PAPER. Whether it's a direct mail piece or a letter or a paper-board container—think of it as a challenge to you and to your colleagues. Yes, a challenge to you to see how you can carry on your business and at the same time cut down and cut down and cut down on your company's use of paper.

Remember the whole country is being enlisted in this drive. You'll be a soldier in a mighty army of paper conservers.

And remember, right now, there's no home-front conservation job any more urgent or important than the conservation of paper and paper board.

If your company or your community has not yet organized Paper Conservation Committees, why not start them yourself and now?

Use Less Paper Because

Each 500-pound bomb takes 12 pounds of paper for rings, tops and bottoms.

A fiber container for a 75-millimeter shell takes 1.8 pounds of paper board.

Each weapon part must be wrapped in grease-proof paper and in waterproof paper. A single shipping case of decontaminating apparatus requires 273 square feet of waterproof lining paper.

All kinds of paper are used by the Army, from vegetable parchment, .0015 inches thick, to heavy paper board and wallboard.

Use Less Paper These Ways

Use smaller type sizes and margins. (Any competent printer, in consultation, can point the way to pronounced savings by these means.)

Reduce separators to shoulder height.

Eliminate top and/or bottom pads in every practical instance.

Make scratch pads from stocks of obsolete letterheads, memorandum forms, and other unused inventory.

Cut the weight of paper stocks. (You tell the printer how long you expect a record to endure and he can tell you what stock to order.)

This advertisement prepared under the auspices of the War Advertising Council in co-operation with the Office of War Information and the War Production Board.

LET'S ALL USE LESS PAPER

RELIGHTING PROBLEMS?

DO WE QUALIFY?..
WHAT ARE THE SPECIFICATIONS?..
WHICH MATERIALS ARE AVAILABLE?..
CAN WE GET PERMISSION TO RELIGHT?..
INCANDESCENT OR FLUORESCENT?..
WHAT ARE GOVERNMENT LIMITATIONS?
WHICH FORM OF LIGHTING?..

Consult HOLOPHANE ENGINEERS

Though a plant may be in critical need of better illumination, the government requires clear proof that relighting will directly aid war production. Under these circumstances both plan and method of relighting should be placed in the hands of the most capable technicians. Holophane engineers, recognized authorities on lighting for war production, offer their knowledge and experience for the solution of relighting problems. These services are tendered not in competition with architects or engineers but only to supplement their advice.

HOLOPHANE PRISMATIC GLASS is Ideal for Relighting Today . . .

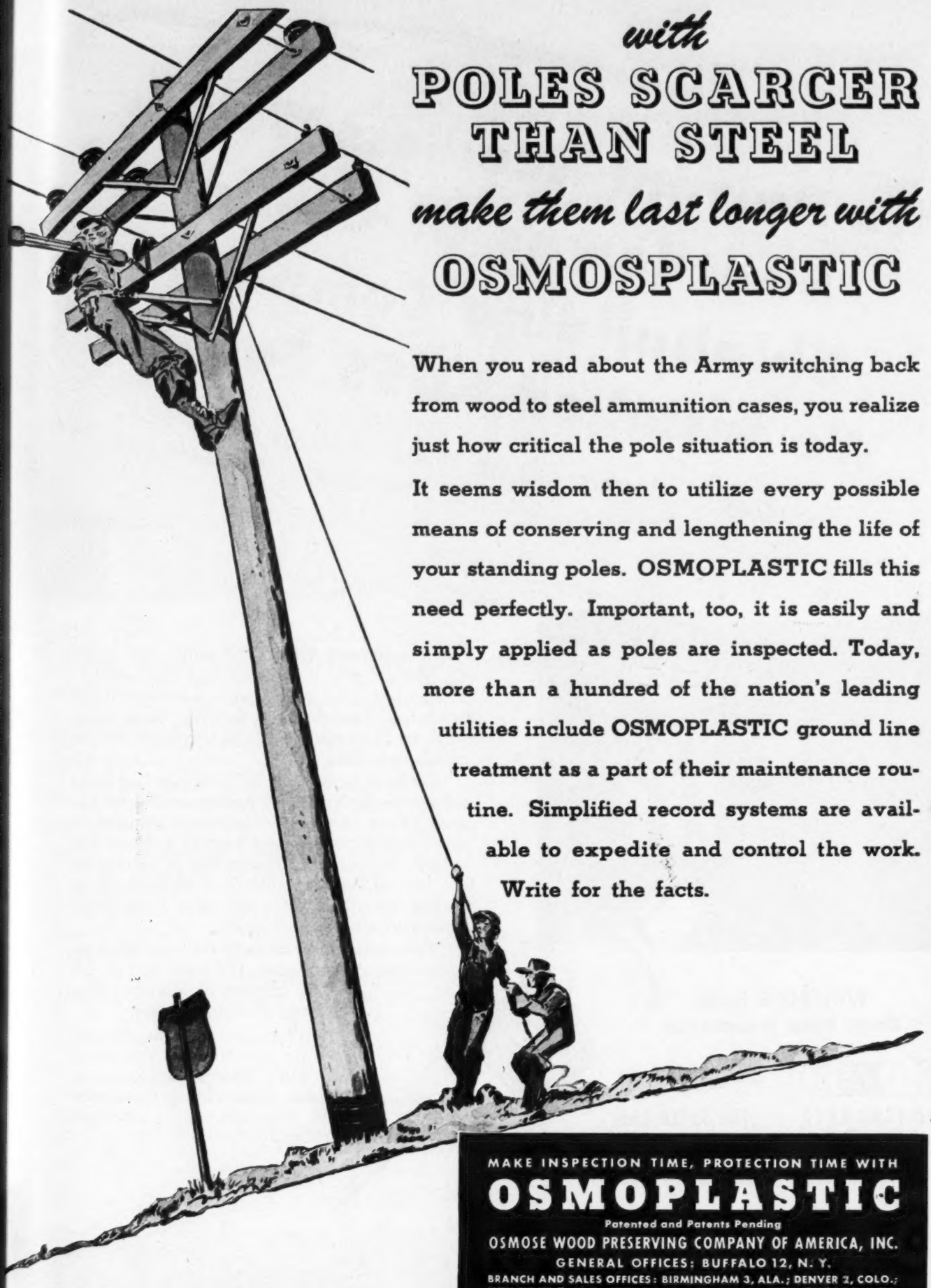
Since its inception this organization has made prismatic glass the basic element for its equipment. Because it is crystal-clear, water-repellent, scratch-resistant and will not warp, glass is the best medium for light control. . . . Holophane *Planned* Lighting assures economies in fixtures, wattage, wiring, in installation and operating costs. It provides correct seeing conditions which reduce accidents to both men and machines.

Send for "Guide to Relighting in Accordance with Wartime Regulations." It gives all the pertinent facts as to W.P.B. Restrictions; also engineering procedure and recommended equipment. Available without charge.

Holophane

HOLOPHANE CO., INC. LIGHTING AUTHORITIES SINCE 1898

342 MADISON AVE., NEW YORK HOLOPHANE CO., LTD., 385 YONGE ST., TORONTO, CAN.



with

POLES SCARCER THAN STEEL

make them last longer with

OSMOSPLASTIC

When you read about the Army switching back from wood to steel ammunition cases, you realize just how critical the pole situation is today.

It seems wisdom then to utilize every possible means of conserving and lengthening the life of your standing poles. OSMOPLASTIC fills this need perfectly. Important, too, it is easily and simply applied as poles are inspected. Today, more than a hundred of the nation's leading utilities include OSMOPLASTIC ground line treatment as a part of their maintenance routine. Simplified record systems are available to expedite and control the work. Write for the facts.

MAKE INSPECTION TIME, PROTECTION TIME WITH

OSMOPLASTIC

Patented and Patents Pending

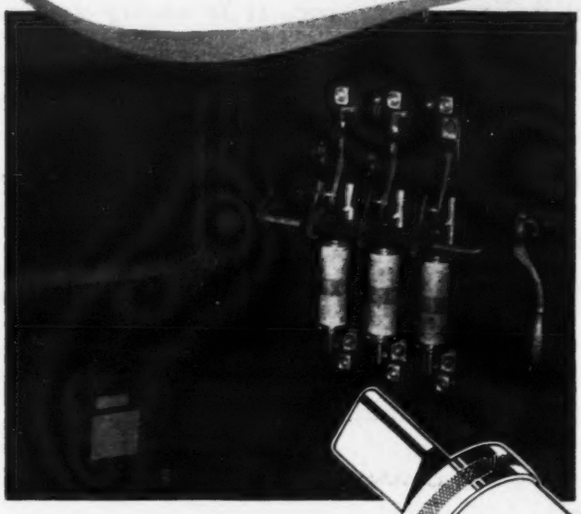
OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.

GENERAL OFFICES: BUFFALO 12, N. Y.

BRANCH AND SALES OFFICES: BIRMINGHAM 3, ALA.; DENVER 2, COLO.; NEW YORK 7, N. Y.; KENOVA, W. VA.; HARLAN, KY.; CHICAGO 4, ILL.

"To Prevent Needless Welder Shutdowns at Globe Shipbuilding Company We Installed BUSS Fuses,"

Says CONTRACTOR, MR. FRANK MAHAN OF BENSON ELECTRIC COMPANY, SUPERIOR, WISCONSIN



"At the Benson Electric Company," adds Mr. Mahan, who is manager and chief electrical engineer, "we have standardized on BUSS Super-Lag fuses for the past 7½ years, using them exclusively on all wiring and motor installation jobs.

"We have found that BUSS Super-Lag links and the design of BUSS fuse cases can be depended upon to prevent needless shutdowns of heavy starting equipment such as welders and motors. It is doubly important in shipyards like the Globe Shipbuilding Company, that are rushing material for war, that outages be held to an absolute minimum.

"This installation includes 10—400 ampere feeder circuit switches. Off each is run 24—60 ampere circuit switches serving electric welders.

"From our past experience we are sure that the installing of BUSS Super-Lag fuses at Globe Shipbuilding Company will eliminate many needless production losses."

Why BUSS Fuses Don't Blow Needlessly

10 FEATURES in the design of the FUSE-CASE help make it possible...

plus

The SUPER-LAG development in the FUSE-LINK completes the job.

BUSS Super-Lag

You, too, can profit by standardizing on BUSS fuses

Mr. Mahan's experience that led him to specify BUSS fuses at Globe Shipbuilding Company is a typical reaction of men who have tried these fuses. It is proof that shutdowns caused by needless blows can be prevented—and adequate protection can be provided in the same protective device.

As for BUSS Super-Lag fuses—the experience of thousands of plants throughout all industry has proven time and again that by using them you can obtain trouble-free protection at a lower overall cost than with any other renewable fuse.

They require no maintenance or periodic inspection. They don't open needlessly. If one opens, you know there is some fault that needs correction.

Here is Why BUSS Super-Lag Fuses Greatly Reduce or Entirely Prevent Needless Blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus, excessive heat which causes fuses to blow when they should not is prevented.

The fuse link used is the famous "BUSS SUPER-LAG." It has lag-plates attached which give it a long time-lag so that unusually heavy starting currents or other harmless overloads will not cause the fuse to blow.

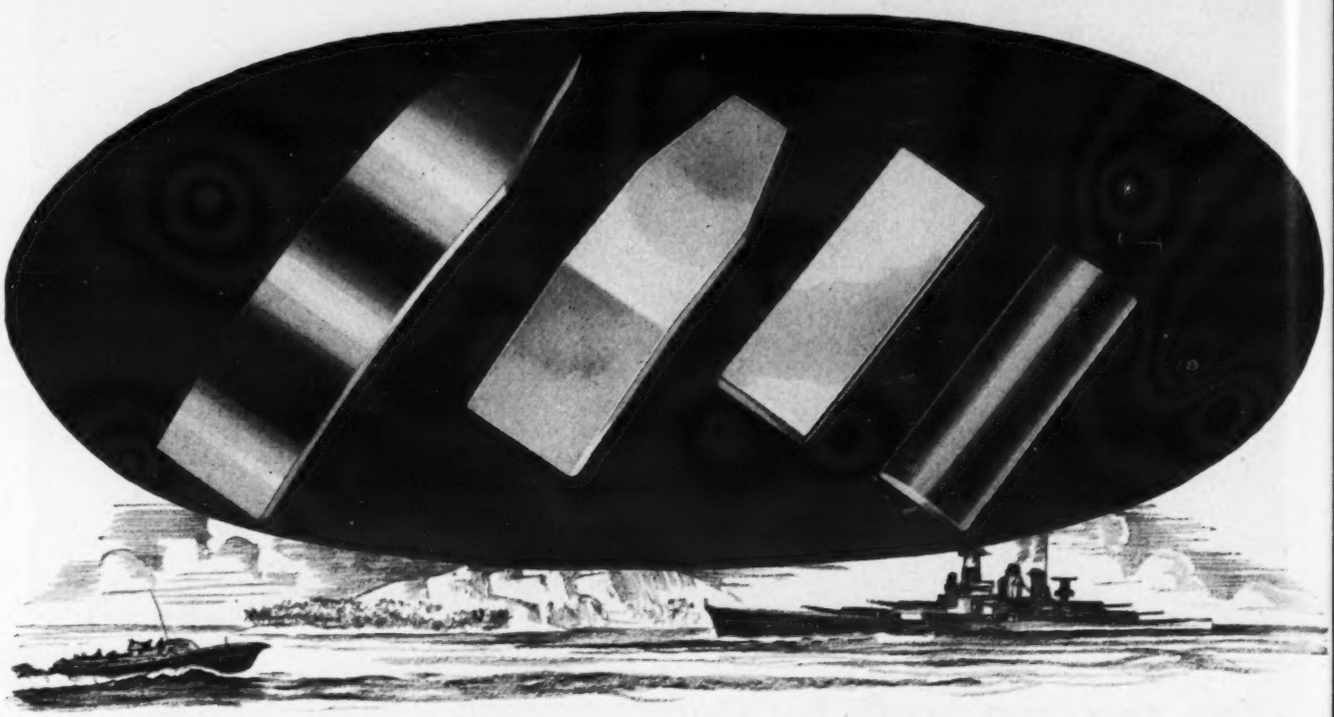
And Here is How to Solve the "Shutdown Problem" in Your Own Plant

Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses give.

BUSSMANN MFG. CO., University at Jefferson, St. Louis, Missouri, *Division McGraw Electric Company.*

FUSES Sold Through Wholesalers

You're Looking at the Nerve Center of a U. S. Fighting Ship



They're not exactly impressive looking, these little strips of metal. But they're mighty important to a man of war. They are contacts that rule the electrical system! And the electrical system controls the ship!

No wonder manufacturers of circuit breaker equipment are put to the test maintaining U. S. naval specifications, highest in the world. No wonder materials for contact facings are the finest that money can buy—rugged, dependable, fit for action no matter what conditions are encountered at sea.

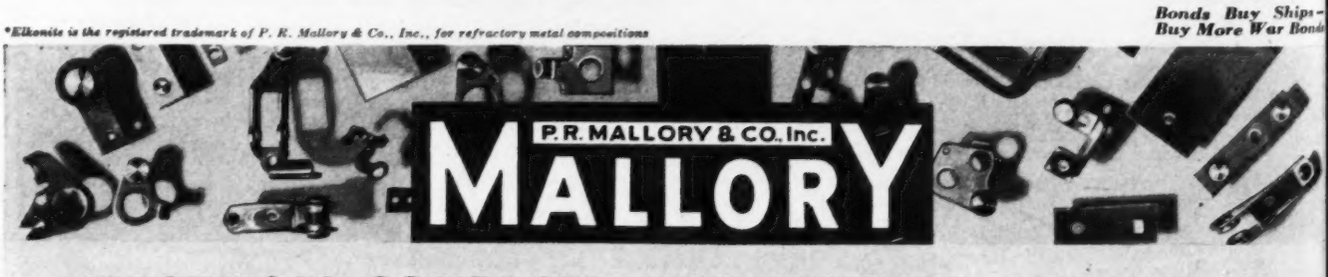
That's why in so many circuit breakers—from PT boats to battleships—you'll find contacts of Elkonite*, or other Mallory alloys of that versatile family. Mallory metallurgists have developed these metals to provide the finest metallurgical structure in combination with varying degrees of hardness and conductivity until they afford, individually or in combination, practically every desired characteristic.

The same engineers who produce Mallory metals are ready to help you in your contact problems, whatever the field to which they apply. Their services are available without obligation—tested and tried by years of experience—and backed by the only company making electrical contacts for every kind of application.

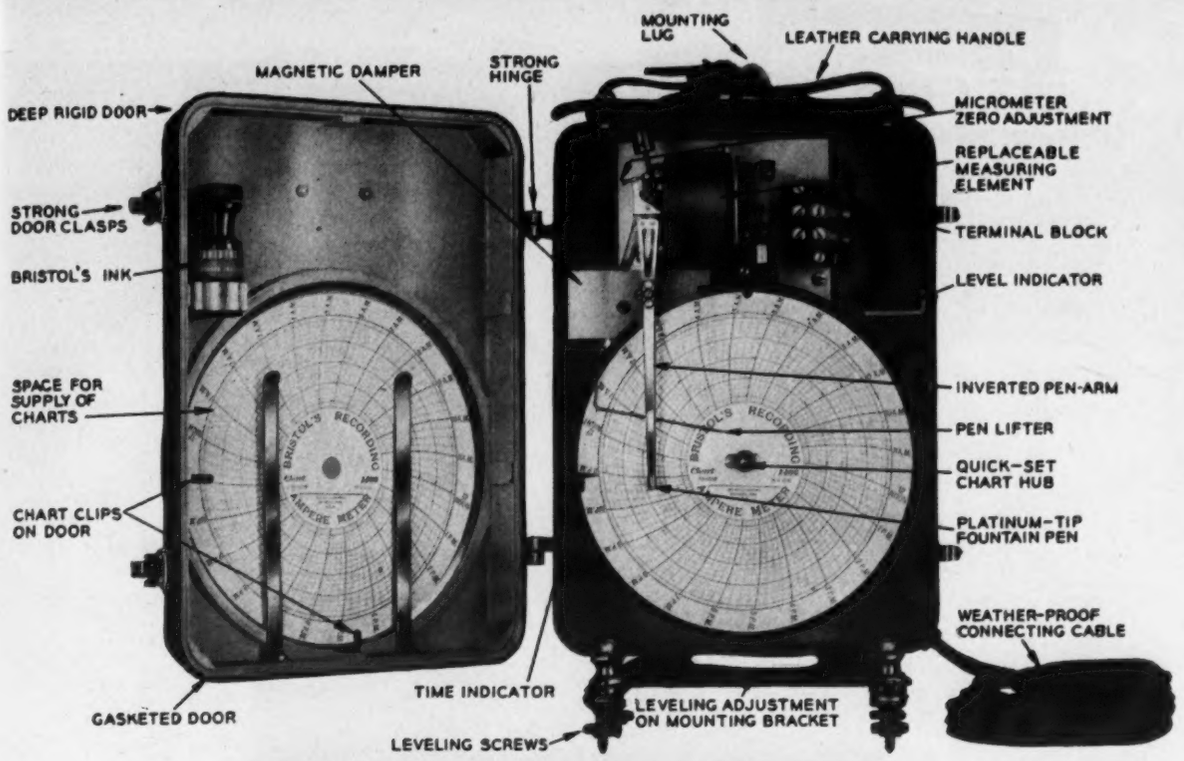
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Bonds Buy Ships—Buy More War Bonds

*Elkonite is the registered trademark of P. R. Mallory & Co., Inc., for refractory metal compositions



ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES
NON FERROUS ALLOYS, POWDERED METAL PARTS



Inside Facts about Bristol's Model 622MP Portable Recording Ammeter

KEEPS YOU UP-TO-THE-MINUTE ON CURRENT EVENTS . . . any place, any time!

On a pole, down a manhole, mounted on a wall, standing on a table or placed on a damp cellar floor, Bristol's Portable Recording Ammeter responds instantly and accurately to the slightest fluctuation in current . . . signals circuit overloads . . . gives time to fix things up before serious damage is done. This 17-pound package of trouble-shooting efficiency is built to take rough treatment and give accurate records in return. Here's what we mean:

LOCKING DEVICE
Movement can be rigidly locked to prevent damage while traveling by truck from one location to another.

GASKETED DOOR
The snug-fitting door shuts out moisture, corrosive gases and dust. So — it's right at home outdoors or in damp cellars or manholes . . . without further protection.

MAGNETIC DAMPER
The damping effect, derived from Alnico permanent magnets, speeds response to ½ second for full deflection. Is practically unaffected by temperature.

REPLACEABLE MEASURING ELEMENT
You can replace the measuring element simply by removing the screws and dropping in a new unit in a few minutes without disturbing the case.

Available in one-, two- and three-pen models for ranges up to 10,000 amperes, Bristol's Portable Recording Ammeters are well worth investigating further. Bulletin 543 makes interesting reading. Write for it today.

BRISTOL

THE BRISTOL COMPANY
116 BRISTOL ROAD, WATERBURY 91, CONN.

The Bristol Co. of Canada, Ltd., Toronto, Ontario

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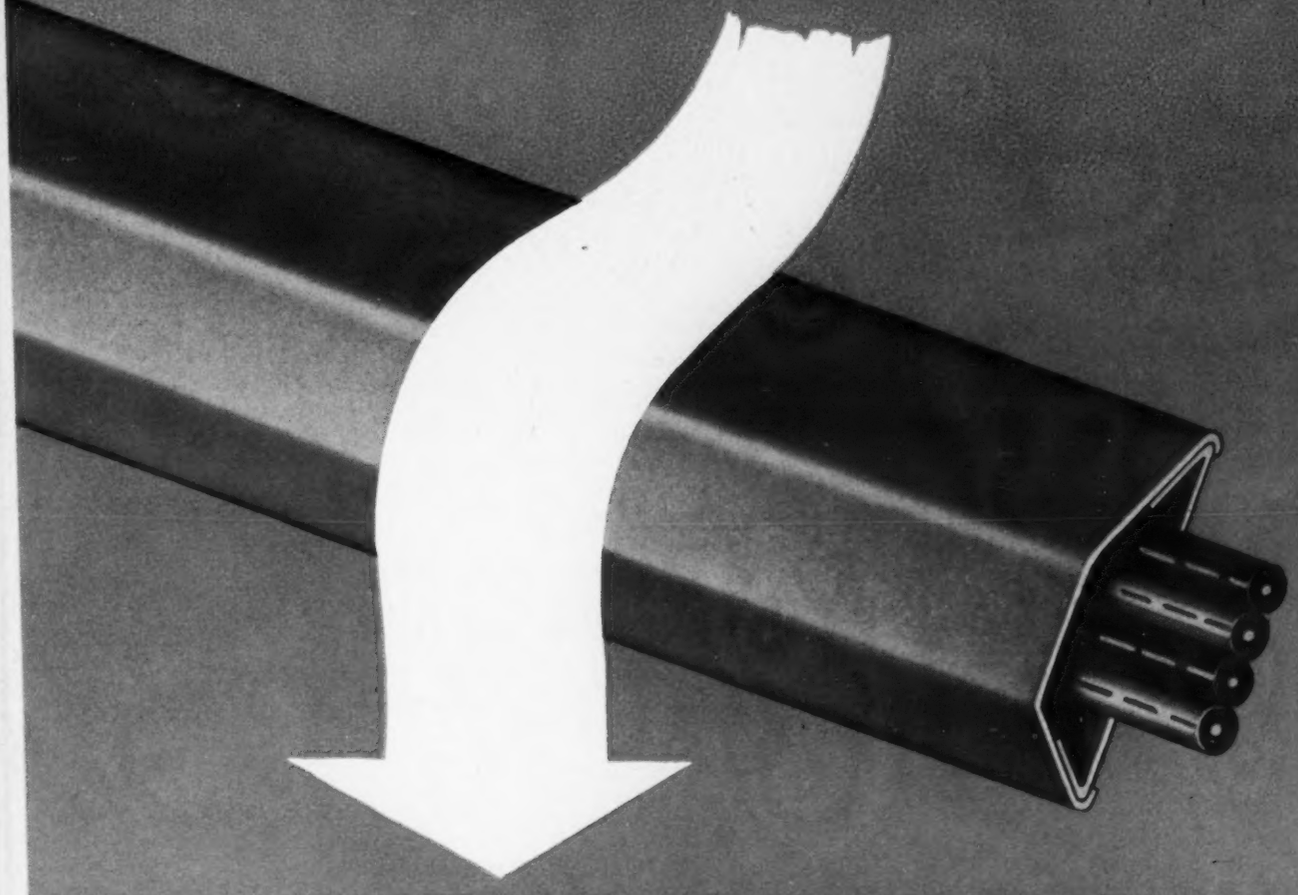

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When Johnny Comes Marching Home

Many people are getting tired of hearing so much about post-war planning because they think too much attention is being paid to after-victory activities when more should be paid to winning the war. There is one phase of post-war planning, however, that even they cannot overlook and that is planning for the re-employment of people as they are mustered out.

When the men and women who left jobs to go into the armed services went around to the front office to say good-by, they were all assured that their jobs or better would be waiting for them when they came back. These assurances were not lightly made. Employers meant every word of them, but how many have backed up these good intentions with actual workable plans for post-war reemployment?

How many employers, in fact, have even started to analyze their own situations?

The Selective Service Act assures every draftee who is qualified that if he applies for his job within forty days of discharge he can have his job back or one equally as good without loss of seniority. Such is the letter of the law but beyond it is the spirit. Just to bring people back at equal pay without loss of seniority is not enough. Men and women returning from service must not be made to feel that they are poor relations who must be supported. They must be welcomed back.

Before that welcome can be real, however, a great many decisions must be made and there won't be time then to come to carefully thought-out conclusions, because the problems are so many. For instance, here are some of the more general ones:

Does the returning service man get back the same job he left, or does he get the job he would have had through regular advancement had he stayed?

Will his salary be that which he had before joining up or what the job now pays or what comparable jobs command in the community?

If his job has been discontinued what will he be given?

The fellow who has been away two or three years will be rusty. What sort of a refresher training program will be available to him?

Many replacements have been women and older people. Will they be kept or dismissed? If dimissed, what provisions have been made for dismissal compensation?

A number of employees have been loaned to war industries with the understanding that they were to come back after the war. Are they going to come back and what plans are made for them?

Utilities should be particularly anxious to have their "welcome home" plans well prepared because they will want to do nothing that might injure their employee relations and through them their public relations. Years of careful work in public education can be lost in a few weeks if the returning service men feel that they are being treated like charity patients.

Observance of the letter of the law will not be enough. It will be the spirit of the observance and that takes planning—the kind of post-war planning that must be done now—that must not wait until Johnny comes marching home.

Insulators Washed on Energized 132-Kv. Line

Practice of washing 132-kv. insulators "hot" is developed by Los Angeles Bureau to meet lack of spare lines under war conditions and demands for uninterrupted power supply

M. V. EARDLEY, Supervisor of Substation Design, Department of Water and Power, Los Angeles, Calif.

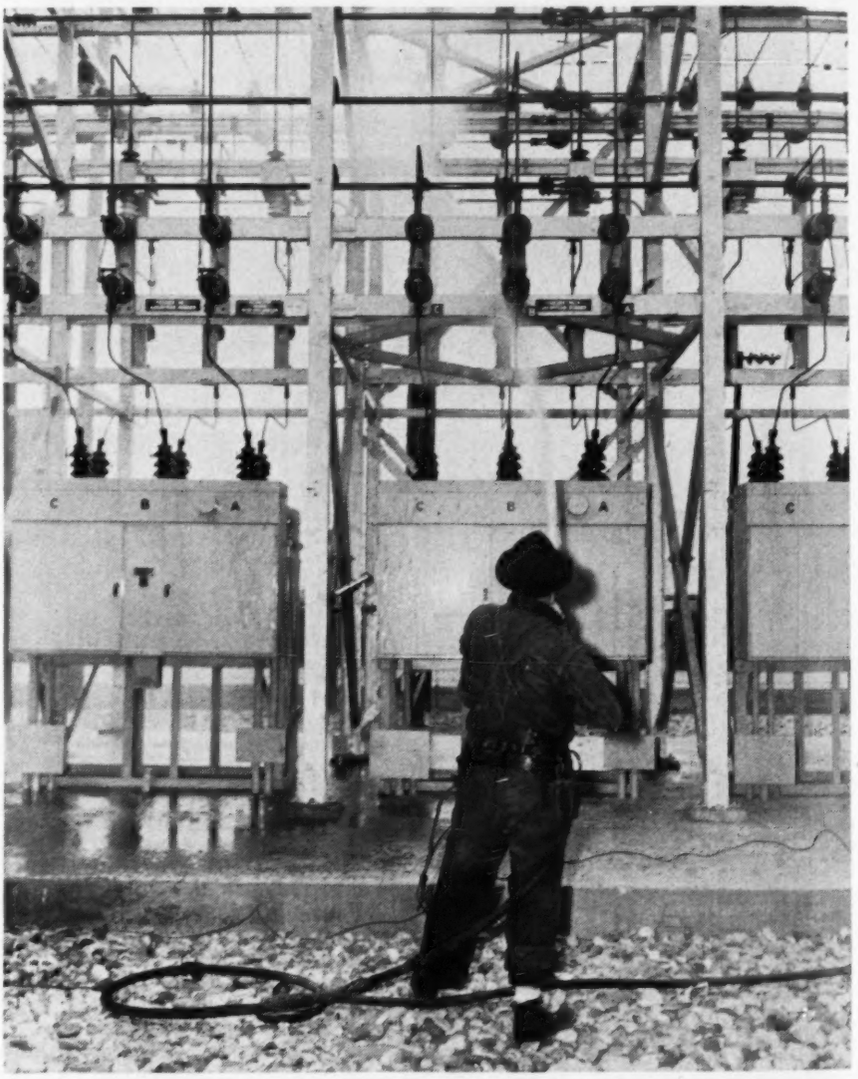
STATION EQUIPMENT and overhead transmission line insulators on circuits operating at 132,000 volts are now being washed by the Department of Water and Power, Los Angeles, while fully energized and carrying normal load. So far as known this is the only utility to adopt a regular schedule of washing hot equipment and insulators on steel tower structures operating at or near this high voltage.

This revolutionary innovation was adopted as a wartime necessity by the electrical maintenance section of the department under the combined pressure of WPB limitations restricting the use of critical materials to the minimum normal operating bare-bone necessities without spare line capacity, and of the specific need of aluminum reduction and chemical synthetic rubber plants for uninterrupted power service. A prolonged outage to an electrolytic reduction plant might entail the loss of from 10 to 14 days production.

Existing Conditions

There is an atmospheric condition local to Los Angeles entirely foreign to any war or other unusual circumstance which defies any standard outdoor line insulator to sustain high voltage without periodic washing. June and July are invariably dry months free from rain. Borne upon the breezes of August, the atmospheric dust from the dry soil settles upon the insulators and, if not removed, the September fogs convert the sediment into a wet conducting mass, and reduce to virtually zero the effective creepage surface of an insulator. Onshore winds throughout the year carry salt contaminations effective up to about 12 to 15 miles inland, which further accentuates this condition.

Unless the insulator is washed after the deposit of dry dust and prior to the foggy season, flashovers on high voltage lines in this vicinity are inevitable. With the recent advent of many large industrial plants in the Los Angeles area, the difficulties to be met in maintaining clean insulators in the vicinity of the plants have multiplied many fold. This is due not only to increased atmospheric dust from building construction, but to the

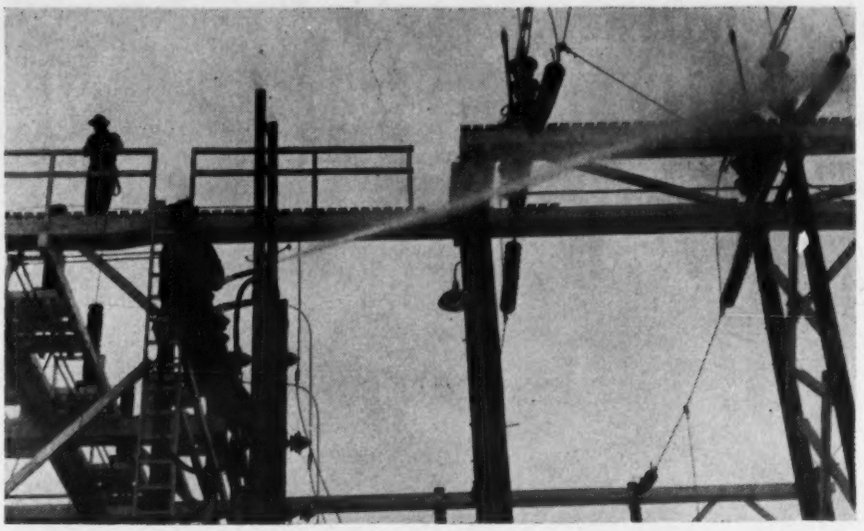


WASHING INSULATORS and bushings on 13.8-kv. substation rack. Pressure is 350 lb.

presence of air-borne substances from the stacks and kilns employed in the various industrial processes.

To have followed the pre-war practice of removing 132-kv. lines and equipment from service for cleaning might have affected the production of vital war materials. To avoid this, an investigation was made to determine if the insulators on the lines and on the 132-kv. industrial station that serves the plants could be safely washed while "hot," without personal hazard to the crew.

Laboratory tests indicated that this could be done, but before adopting a regular program of washing 132-kv. lines, actual field trials were conducted on isolated 110-kv. lines without any untoward incident. As a result, the department is now washing 132-kv. lines with ordinary tap water using a nozzle opening of ⅛ in. to ¼ in. at a pressure of 700 psi. developed by a pump mounted on a water tank truck, as shown.



WASHING 132-kv. station bus insulators safely while hot and carrying load. Water pressure of about 750 lb. at pump is used

Washing Precautions

To prevent flashovers while washing insulators on 132-kv. tower lines, it is important to guard against any spray reaching a dirty insulator. The full stream should be first directed squarely at the lowest insulator and then the washing carried progressively from the bottom towards the top of the tower so that the dirty insulators do not become moistened before the full stream is played upon them. Likewise, in washing station equipment similar to that shown in the accompanying photograph, it is important first to wash the insulators on the leeward side so that the wind will carry the spray away from any unwashed insulators, then to wash progressively back from the leeward to the windward side.

After an insulator is cleaned, there no longer is danger of flashover from stray mist. If heavy fiery electrostatic streamers are observed while washing insulators, they may be extinguished by turning the full stream squarely at the fiery streamers.

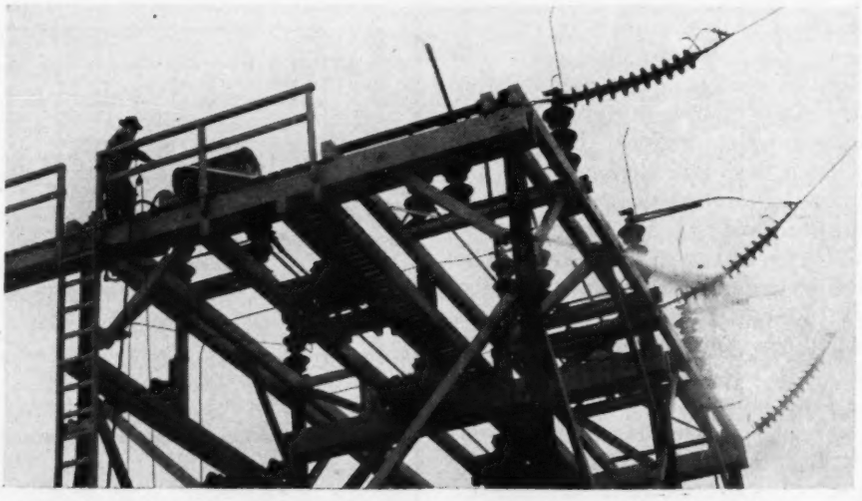
Before commencing operations, the hose nozzle and the water truck tank and pump should be solidly and effectively grounded by a heavy cable connected to the station ground or tower leg. The water should be brought up to full nozzle pressure before directing the stream on or near a live part.

To demonstrate the dangers of a poor ground connection, a test was conducted with the ground connection to the truck and tank body removed. Under these conditions there was a measurable high voltage between the truck and the ground, which with dry tires might approach line voltage. When a grounded conductor is then placed in momentary contact with the truck, the discharged current of the capacity established by the truck to ground is many times the steady value of the current.

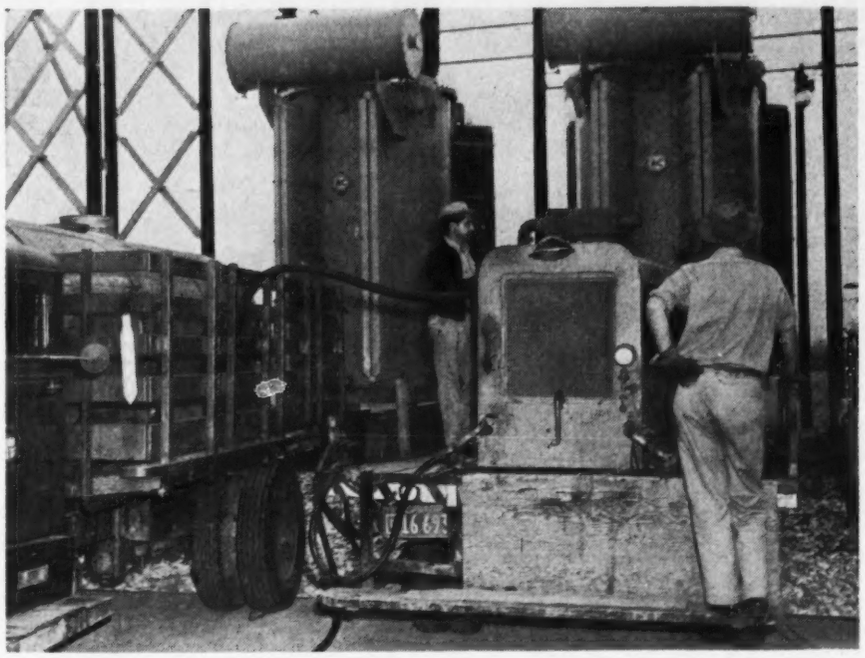
As a matter of precaution, therefore, it is tremendously important, when using a truck for washing, to be certain that no person gets on or off the truck during the operation, and that all persons are kept safely away from the truck. Persons on the truck should also take care not to reach out and touch any adjacent tree, pole, tower, or other object.

Prior to washing 132-kv. equipment as a war expedient, extensive laboratory tests had been made to determine if there were any unusual hazards involved in the operations. By first obtaining the magnitude of the currents that would flow through the water stream from line to ground at various voltages and nozzle distances, and then determining the maximum current that may safely pass through the human body without harm or annoyance, the conditions prerequisite to safe washing operations were established.

Tests were conducted at potentials



CARE MUST BE USED to prevent water spray from blowing onto unwashed insulators which will cause streamers and possible flashover



WATER TRUCK (left) and pump truck (right) used to supply the water pressure needed for hot insulator washing

from 25 kv. to 175 kv. above ground. Two sizes of nozzles connected to standard water hose were used, the larger of which was operated at a pressure of about 250 psi., and the smaller at a pressure of 750 psi. The water from the city's system had a resistivity of 1,710 ohms per centimeter-cube at 30 deg. C. Tests were made with the nozzles located at 10 ft., 16 ft. and 21 ft. from the energized lines. During each test the nozzle and the truck which carried the high pressure pumps were connected to ground through a milliammeter with a total ground circuit resistance, including the meter resistance, of from 1,000 to 2,500 ohms.

The accompanying table presents the total ground current in milliamperes which flowed under each condition of voltage and nozzle to line separation, both with and without the nozzle water stream. The current without the water stream is that due to the electrostatic capacity between the energized lines and washing truck.

The resistivity of water varies with the temperature. A stream of water at 130 deg. F. may carry twice as much current as a stream at 65 deg. F., other conditions being the same.

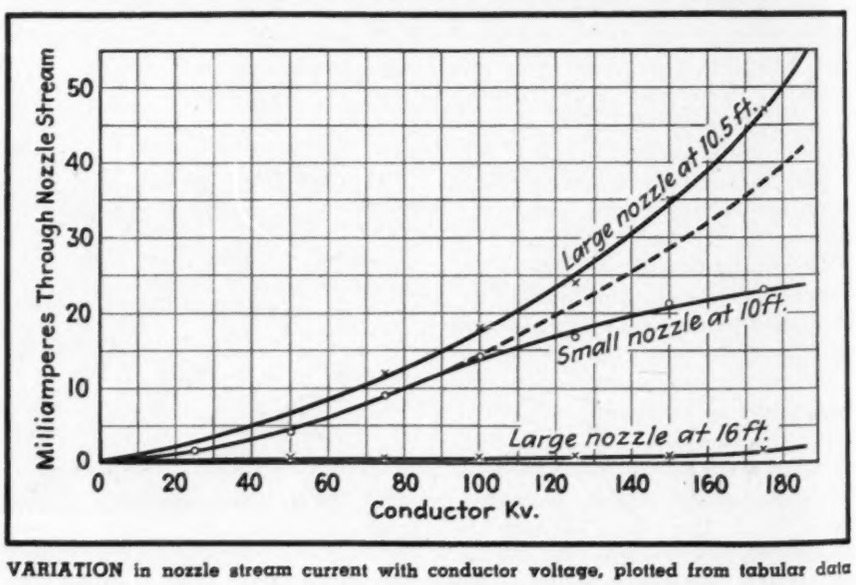
Independent tests made several years ago at a leading university indicated that, at a frequency of 60 cycles, a current of 1 milliampere passing through a human body will just be felt; currents from 4 to 10 milliamperes, depending on the individual, will cause a sense of pain. A current of 30 milliamperes is dangerous and may cause unconsciousness; 100 milliamperes can be fatal.

Parallel tests were made by the department on 37 human subjects in an effort to determine the threshold of 60-cycle electric current feeling and the threshold of uncomfortableness. To the average man tested the threshold of feeling for current passing from an electrode grasped in one hand only, to a grounded plate on which the man was standing, was 1 milliampere, and the corresponding uncomfortable threshold was 3.4 milliamperes. With both hands grasping the electrode, the corresponding thresholds were 2.2 and 6 milliamperes, respectively.

Considering 2 milliamperes as the limit of current that will assure complete freedom from uncomfortable feeling, and by allowing a factor of safety of five for variation of water resistivity, from the table it would appear that a man may safely wash 132-kv. lines operating at 80 kv. to ground with nozzle pressures not below 250 lb. and with distances not less than 15 ft. from the conductor. In practice the current is bypassed by having the nozzle grounded and a pressure of 750 psi. is employed, so there is a large margin of safety.

Milliamperes of Current from Truck to Ground at Various Voltages, Distances and Water Pressures

Conductor voltage, line to ground, kv.	LARGE NOZZLE									SMALL NOZZLE		
	At 21 ft. 250 lb. Water			At 16 ft. 250 lb. Water			At 10.5 ft. 250 lb. Water			At 10 ft. 750 lb. Water		
	Off	On Avg.	On Max.	Off	On Avg.	On Max.	Off	On Avg.	On Max.	Off	On Avg.	On Max.
25										0.06	1.25	1.4
50	0.12	0.14	0.14	0.15	0.18	0.18	0.15	5.0	5.0	0.16	3.50	4.0
75	0.14	0.17	0.17	0.175	0.25	0.30	0.195	9.0	12.0	0.22	7.50	9.0
100	0.16	0.19	0.19	0.21	0.30	0.50	0.25	12.0	18.0	0.27	12.0	14.0
125	0.175	0.22	0.22	0.24	0.37	0.80	0.31	20.0	24.0	0.33	15.0	17.0
150	0.20	0.26	0.26	0.28	0.50	1.20	0.38	32.5	35.0	0.41	19.0	21.0
175	0.22	0.31	0.31	0.33	0.80	2.00	0.47	42.0	47.0	0.47	20.0	23.0



VARIATION in nozzle stream current with conductor voltage, plotted from tabular data

Higher-Voltage Distribution Successful in Dallas—II

Six years experience with 13.2 kv. common-neutral primaries shows benefits of low cost, high efficiency, flexibility for local expansion, reduced voltage drops, less pole congestion, fewer substations

H. K. DOYLE, Operating Superintendent, Dallas Power & Light Co., and
W. R. BULLARD, Electrical Engineer, Ebasco Services, Inc.

BASED on experience with the Dallas 13.2-kv. general purpose distribution system to date (see ELECTRICAL WORLD, April 1, 1944, page 48) the following principal advantages are afforded by use of the subtransmission voltage for primary circuits:

(a) *Cost.* One transformation is eliminated and the amount of copper required for primary circuits is greatly reduced. These savings are of special importance to the country in war-time but are of large importance to the electric service company either in war or peace. The cost savings are somewhat offset by the higher cost of 7,620-volt distribution transformers with accessories, but the net saving is appreciable. The Dallas study showed that growth of load could be handled at lower cost by converting portions of the system to operation at the higher voltage than by building the new substations and running the new 4-kv. feeders necessary to care for a corresponding amount of load.

No data are available on relative operating and maintenance costs for the two types of systems in Dallas but it is the opinion of the operating personnel that the two do not differ greatly as regards primary circuits and distribution transformers. Of course substation operating and maintenance costs are much reduced because of the elimination of transformer substations and the reduction in number of automatic circuit breakers required for controlling primary circuits. The elimination of regulators on some of the primary circuits also has been a factor in the case of the Dallas system.

(b) *Load Carrying Ability.* In a given area, conversion from 4-kv. to 13.2-kv. operation without changing circuit copper sizes and without increasing the area served by each individual circuit, multiplies the load-carrying ability of primaries by 11 as limited by voltage drop, and multiplies it by 3.3 as limited by conductor temperature. In practice somewhat lower increases in load carrying ability are obtained ordinarily because larger areas are allocated to individual circuits, also because advantage is taken of lower voltage drop and lower energy losses. Nevertheless the basically high capacity of the higher voltage system for handling load growth is readily apparent.

(c) *Efficiency.* The energy losses involved in one transformation are eliminated, and losses in primary circuits for a given amount of load and a given amount of copper are greatly reduced. No data are available concerning the actual electrical efficiency of the Dallas 13.2-kv. system, but calculated efficiency worked out in connection with the original study of the specimen residential area amounted to 96.4 percent at the time of conversion and 95.5 percent after a period of ten years growth of load. These figures included losses from primary source to secondaries of distribution transformers.

(d) *Flexibility.* Distribution system planning, instead of involving periodic construction of new transformer substations and readjustment of 4-kv. primary layouts, becomes merely a matter of maintaining adequate load-carrying capacity in the subtransmission system and in the primary circuits. Relatively heavy (concentrated) customers' loads frequently can be served at scattered points without noticeably burdening existing primaries. The simplicity and basically high load-carrying ability of the system make for a high degree of ease and flexibility in serving load growth.

(e) *Voltage Regulation.* Voltage drops in primary conductors are generally small as compared to those in 4-kv. circuits. This reduces the spread in voltage from point to point and aids in keeping overall spread within acceptable limits. The need for individual circuit regulators is reduced and may be obviated if bus voltages can be controlled to conform reasonably well with service voltage requirements.

(f) *Pole Congestion.* Congestion of outgoing 4-kv. circuits in the vicinity of transformer substations is a familiar sight in conventional 4-kv. systems, although mitigated within recent years by the use of small unit type stations. Pole congestion is minimized by the use of 13.2-kv. primaries since the number of circuits required to serve a given amount of load is greatly reduced, and circuits of only the one voltage are present in the area served.

Operating Experience

In the beginning a few operating difficulties were encountered, some of which were attributable to new types of equipment rather than to the change of voltage. A number of failures of the built-in lightning arresters of the self-protecting transformers were experienced. This difficulty was

corrected by the manufacturer. A prominent cause of circuit tripouts was found to be short circuits of the transformer cover-type bushings caused by birds and rodents. This has not been entirely corrected but a solution has been found in a porcelain cover for the live parts. A program is in progress for equipping transformers with these covers in areas where this type of trouble is prevalent. In order to avoid radio interference it was found necessary to have tie wires make metallic contact with primary conductors and direct contact with the porcelain. This meant scraping off the weatherproof covering of the older conductors at the insulators. Some radio interference from insulator corona also was experienced. Two remedies were found for this, (a) radio interference proof insulators, and (b) insulator pins with wooden tops.

Service Continuity

At present service continuity is highly satisfactory. The following data show the performance as regards line interruptions for the year 1942:

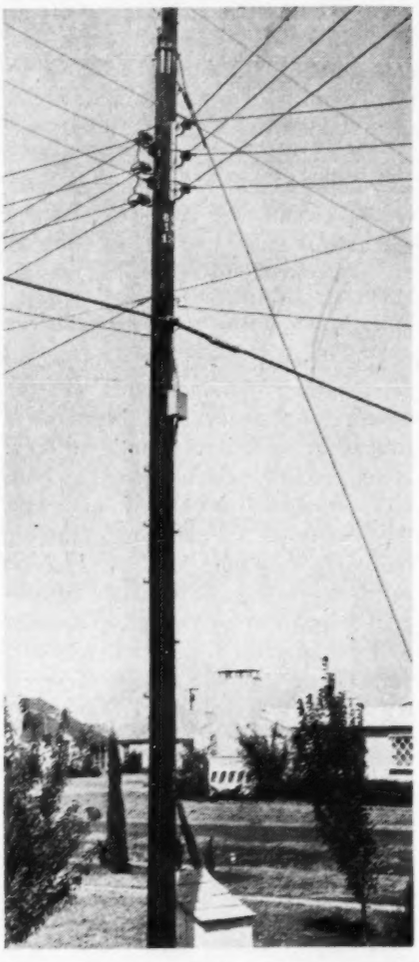


FIG. 1—Joint construction of 13.2-kv. line and telephone circuits on service pole

On the five circuits equipped with coordinated fuse-breaker protection representing 326 miles of circuit there were 197 initial circuit breaker operations; 183 of these or 93 percent resulted in successful first reclosure. There were six successful second reclosures and six successful third reclosures, leaving only two lockouts representing one percent of initial operations. This represents considerably less than one lockout per hundred miles of line. One of these two lockouts involving an outage of 20 minutes was due to a cable failure in the trunk circuit. The other was on a circuit having single-shot reclosure and involved an outage of four minutes. The breaker was successfully reclosed by hand and no damage was discovered.

On these same circuits there were eight instances of branch or sectionalizing fuses blown in connection with breaker operations, and 14 branch fuses were blown without breaker operation. These latter represent faulty fuse operations and improvement can be expected as more experience in coordination technique is gained. On these circuits there were three cases of fused cutouts dropping open or being knocked open.

Fuse Outages

A count of the branch or section outage record for 1942 of a typical one of the five coordinated circuits indicates that, on the average, roughly 15 transformers representing 150 kva. of capacity were disconnected by a fuse outage. This is less than one-tenth the amount of transformer capacity ordinarily involved in an outage of a well-loaded conventional 4-kv. circuit with 4/0 feeder conductors.

With regard to the momentary interruptions shown in the foregoing data there have been only two cases since the installation of the first rapid reclosing circuit breaker where such interruptions caused unsatisfactory service. These two cases were synchronous motor installations and have been corrected.

In 1942, on the three manual reclosing circuits representing 121 miles of circuits, there were eight initial breaker operations, of which seven or 87.5 percent resulted in successful first reclosures, and one resulted in a lockout.

These circuits are equipped with 44 three-shot reclosing fuses controlling branches, and some additional single-shot fuses also controlling branches. The following performance data for 13.2-kv. reclosing fuses during 1942, which include a number of units installed in areas outside the districts served by the general purpose distribution system as well as those in such areas, will serve to indicate general performance of this type of equipment under Dallas conditions:

	Occurrences Per 100 Units In Service
One fuse found blown, service maintained ..	45
Two fuses found blown, service maintained ..	3
Three fuses found blown, service interrupted	14
Reclosing mechanism failed to operate....	8
Total	70

On the three manual reclosing circuits during the year 1942 there were 39 single-shot branch fuses blown.

Transformer Outages

The following data show the performance for 1942 of the 2,892—13.2-kv. transformers on the system:

Cause	Number of Outages	Number of Outages Per 100 Transformers In Service
Lightning .	43	1.5
Short Circuits and Grounds .	66	2.3
Overload from utilization ..	69	2.4
Miscellaneous .	98	3.4
Total	276	9.6

Note that these figures cannot be compared directly with those of a purely radial system, because of the fact that the majority of these transformers are paralleled on the secondary side with one or more other units. For purposes of the record, a fault which takes—say three transformers out of service—is counted as three outages. On the other hand there are transformer faults which do not interrupt service because of the other units remaining connected. Such

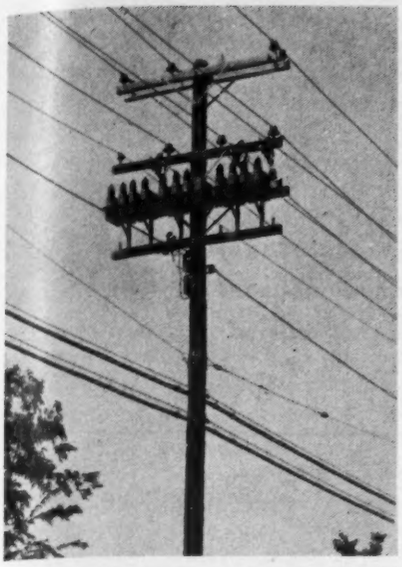


FIG. 2—Three-phase wye-connected bank of capacitors (180 kva.) on pole in residential area served by 13.2-kv. primaries

faults are not included in the record.

Of these 276 outages, 180 involved fuses blown or secondary breakers open without damage to transformer, 10 involved damage to winding, and 86 involved other types of damage.

No circuit and transformer performance data for the 4-kv. system comparable with the foregoing are available since the load density and exposure characteristics of the territory served by the remaining portion of the 4-kv. system differ widely from those of the 13.2-kv. system. However, it is the judgment of the operating personnel of the company that, neglecting momentary outages, the service continuity afforded by 13.2-kv. distribution with the coordinated fuse-breaker protection is at least as good as that which would be provided by conventional 4-kv. distribution with average-sized circuits and the usual type of reclosing cycle.

The 13.2-kv. circuits are worked alive with hot line tools plus rubber gloves. This takes a little more time than that required for work on the 4-kv. circuits but no difficulty has been experienced in handling all of the requirements for maintaining service and extending the system.

Tree Conditions Severe

Tree conditions are severe in some portions of the area involved (see cover picture of April 1, 1944 issue of ELECTRICAL WORLD). As a precaution against any possible added difficulty from this source because of the higher voltage, special attention has been paid to trimming in the 13.2-kv. areas. As a result tree contacts have represented a relatively small percentage of causes of outages. Trimming is handled by Dallas Power & Light Co. personnel. Trees owned by the city are trimmed on a routine basis by a standing agreement with the city based on confidence in the company's care and reasonableness, established over a period of years. Privately owned trees are trimmed by individual agreements with the owners who in general also have confidence in the company's handling of this work.

Adequate service voltage regulation is maintained notwithstanding the fact that six out of the eight 13.2-kv. circuits are not provided with regulators. This has entailed some planning and adjustment of system voltage operation. However, solution of the problem is aided by the fact that voltage drop from point to point in the 13.2-kv. primaries is appreciably less than that ordinarily encountered in 4-kv. distribution. The maximum amount of drop in primary conductors from station source to most remote load thus far encountered has been about 6.4 percent. This represented an extreme case involving relatively small conductors and a total distance from source to load of about ten miles. This amount of drop occurred on only one phase, and a perfect balancing of the load on the three phases would have reduced it to about 4.9 percent.

Capacitors

There are 68 distribution-type capacitor units on the 13.2-kv. system representing roughly 1,000 kva. These were installed chiefly for the purpose of reducing reactive kva. on the system as a whole, thereby releasing load carrying ability. A much larger amount of capacitor units is in service on the 4-kv. system. The 13.2-kv. units are mostly in three-phase wye-connected banks, a typical installation being shown in the photograph Fig. 2. It was found that where neutrals of these banks were grounded there were more cases requiring inductive coordination with telephone circuits than had been experienced in the case of 4-kv. installations (a negligible amount in the latter case). This was taken care of by the installation of a small reactor in the neutral ground connection of each 13.2-kv. bank of capacitors.

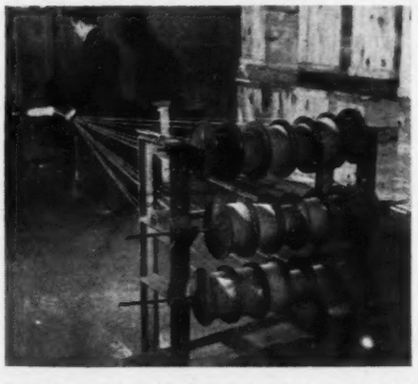
The safety record for the 13.2-kv. system as compared to that of the 4-kv. system has been excellent. Two considerations favoring the higher voltage from the standpoint of safety are: (a) the more positive and prompt de-energization of a circuit or section of a circuit in case of fault, and (b) the tendency of workmen to treat the higher voltage circuits with greater respect.

• • •

Winding Lathe Used to Salvage Wire

A small winding lathe, adapted to remove rejected wire from spools, salvages both the wire and the spool at General Electric's Pittsfield Works. Two steel bars, 14-in. long, 1.5-in. wide and 0.5-in. thick, are welded to the winding machine head so as to make a slightly tapered arbor, 1.5-in. square at the head. Holes 0.5 in. in diameter are spaced around the head plate so that a tie wire can be laid along the arbor and held out of the way when unreeling the wire.

Upon completion of the bundle the tie wire is twisted around it to keep it from breaking apart and it is sent to refineries or foundries for remelting. The spool-holding rack can support 18 10-in. spools or six 24-in. spools. Alternate spools revolve in opposite directions to prevent overrun of the wire and consequent tangling in case the winding machine stops suddenly.



REJECTED WIRE is salvaged, removed from spools and wound on arbor in machine at rear

Fault Current Polarities Compared by Carrier

Progress in electronics and sequence filters affords revived resort to successful transmission line pilot relay scheme which compares polarities of filtered terminal currents

J. T. LOGAN, Operating Engineer, Georgia Power Company

IN ITS present state of confusion, most relay engineers feel they are privileged to their own ideas concerning carrier pilot relay protective schemes. In exercising this privilege the author and his associates started from scratch about three years ago and have succeeded in developing a scheme which is greatly simplified over so-called conventional schemes.

The heart of the scheme is the sequence filter (Fig. 1) which eliminates the need for potential transformers and their associated apparatus, such as power directional relays, distance relays and out-of-step blocking features found in conventional carrier pilot schemes. The sequence filter offers probably the most positive diagnosis for all types of short circuits of any device or combination of devices known to the relay art.

The first approach to carrier pilot relaying known to the author was in 1927, the scheme being similar in many respects to the one described herein. According to many relay specialists this was the nearest approach to an ideal carrier pilot relay scheme that has ever been made. The complexities encountered at the time in modulating the carrier wave with 60-cycle potential probably accounts for the scheme being discarded then in favor of the conventional directional comparison schemes. In the scheme developed by the author and his associates, transmission of information concerning the magnitude of the 60-cycle modulating potential is of little concern and no difficulty has been experienced in phase relation transmission at high frequencies. The electronic phase comparison relay (Fig. 1) eliminates problems previously encountered in transmission of 60-cycle quantities.

In a balanced three-phase power system the vector sum of the currents cancel out to zero. It is possible, however, to mix the secondary currents in a network composed of reactances (special transformers) and resistances in a manner that will produce a voltage quantity definitely related to one of the primary currents, say approximately in phase with current 1. Filters connected in the current transformer secondaries at line terminals will generate single-phase potentials that are in phase with each other for normal load currents or three-phase short circuit currents flowing through the line. For a three-phase line fault, however, these filter potential quantities will be in approximate opposition (180 deg. apart). In these instances the filters extract the positive phase voltage quantity.

For phase-to-phase faults, the filter cancels out the negative phase voltage and uses the positive phase voltage for comparative purposes in the manner described in the above paragraph.

For phase-to-ground faults, the filter extracts the zero phase voltage which is definitely related in phase to the phase current involved in the fault.

In short, the current transformer secondary currents at line terminals are fed into the sequence filter and their behavior in this network produces a voltage quantity which is definitely related to the positive and zero sequence components of the currents at the line terminals. Stating it another way, the single-phase voltage

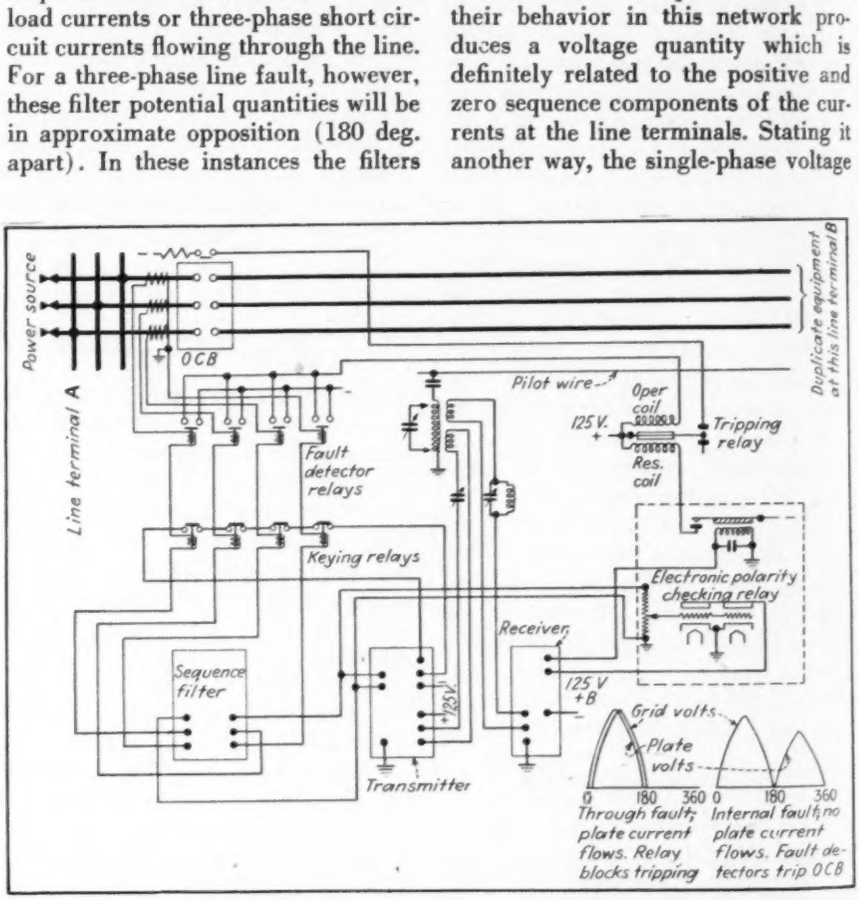


FIG. 1. Carrier current pilot relay scheme compares relative phase angles of terminal fault currents

quantity generated in line terminal filters are approximately in-phase for currents flowing through the line, regardless of whether the predominating currents result from three-phase, two-phase, two-phase-to-ground or phase-to-ground faults.

Conversely, for internal line faults the voltage outputs from the filters are approximately 180 degrees apart, regardless of the type fault.

In this scheme of carrier pilot protection, the sequence filter potential is employed to modulate a carrier frequency which is received at the other line terminal and demodulated into a 60-cycle quantity in phase with the original modulating potential. This demodulated 60-cycle quantity is then compared for polarity with the sequence filter potential at this location in an electronic relay which passes tube plate current only when the 60-cycle waves are positive during the same half cycle, which condition indicates a through fault. Passing of plate current prevents breaker tripping. The electronic relay can be adjusted to block tripping for through faults over approximately a 150 deg. sector.

Operation Checked

This scheme was first applied to the Macon-Thomaston 110-kv. line, 43 miles in length. A company-owned telephone line on the same right-of-way with the power line is employed as the carrier current channel. Some changes in the telephone line protective equipment were made to prevent short circuiting the carrier frequency or protective gap flashovers.

As this development defied conventional carrier pilot relay protective practices, an automatic oscillograph was assigned to checking its performance. More than 150 oscillograms showing either tripping or blocking have been obtained from this and other installations. The oscillograms revealed certain defects in the scheme from time to time all of which, it is believed, have been weeded out. Not once has a faulty operation been traced to the sequence filter's diagnosis of the fault, indicating that the so-called "blind spot" in sequence filters claimed by some to be present is more imaginary than real.

This particular installation has functioned correctly 120 times either to block or trip. There have been a few occasions when the scheme either failed to function or tripped incorrectly but in every instance the cause was quickly determined and corrected. An inferior type of auxiliary relay in the electronic polarity relay plate circuit was the worst offender. Minor changes in electronic circuits and closer inspection for vacuum tube failures should perfect the scheme as near as can be possible until electronic devices become as reliable as the other components making up the scheme.

Oscillograms are usually uninteresting to all except the fellow who obtains them, and with this apology, Fig. 2 is presented. Note particularly (C) —inherent blocking for out-of-step conditions. Only those employing conventional systems of carrier pilot relay protection can appreciate this film.

Distinctive Features

(1) Inherently prevents tripping for out-of-step conditions since the currents measured at each line terminal are in phase or nearly so.

(2) Operates from current transformers only, no potential source being required.

(3) Telephone line adjacent to the power circuit can be employed as carrier current channel, or one of the power conductors may be used for this purpose with suitable coupling capacitors and line traps.

(4) A large number of power circuits can be supervised by use of a single conductor connecting all line terminals. The number of circuits so protected would be limited only by the maximum number of frequencies the conductor-to-ground channel would accommodate without interfering with one another.

(5) Two carrier frequencies are now employed with each installation permitting the use of the transmitters and receivers for communication purposes, if desired. The keying relays would cut off conversation in event of system troubles in less than one-fourth cycle, thus introducing no delay in the relay system. It may be possible to use only one carrier frequency.

Component Factors

(1) Sequence filters connected in current transformers secondaries at line terminals for generating a potential definitely related to the type of fault. The sequence filter is a three-phase device having no moving parts. It extracts a single-phase quantity for comparative purposes.

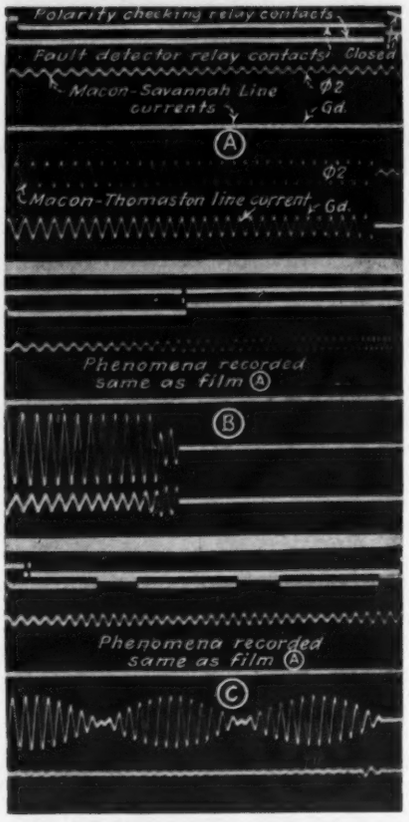


FIG. 2—Oscillograms of carrier pilot relay scheme in action. A—Blocking for through or external fault. B—Tripping for internal line fault; relay scheme applied to 12-cycle breakers. C—Blocking for out-of-step condition

(2) Fault detectors—simple instantaneous type current relays that pick up for abnormal currents and energize the operating coil of the tripping relay.

(3) Transmitter, modulated by the sequence filter potential output.

(4) Receiver for demodulating the received signal into a 60-cycle potential in phase with that used to modulate the transmitter at the other line terminal.

(5) Keying relays—simple instantaneous current relays for starting transmitter on abnormal currents. Also, these relays, in conjunction with the fault detector relays, provide a means for compensating for current transformer ratio inaccuracies.

(6) Electronic polarity checking relay—energizes restraining coil of tripping relay when the instantaneous polarity of the local sequence filter potential received from other line terminal. Relay inoperative for all other conditions, permitting the fault detectors to trip the line breakers instantly.

(7) Fool-proof system for checking the condition of the relay system.

Are Your System Voltages Named Properly?

Many different wye and delta systems have almost identical line or phase voltage—Voltages are used too loosely to identify the systems—Common systems classified in terms of their basic ratios

E. V. SAYLES, General Engineering Supervisor, Consumers Power Co., Jackson, Mich.

CONTINUOUS upward evolution of both primary and basic utilization voltages, in progress for over 50 years on utility transmission and distribution systems, finds the industry today with a welter of voltages and transformer ratios. Close similarity between the voltages of certain wye and delta-connected systems, having different basic primary to secondary ratios, has long been a source of misunderstanding. Aggravated by looseness in nomenclature, this condition has led to many serious and costly mistakes. In purchasing power transformers, particularly, selection of taps has frequently been based on a system "nominal" voltage which is not consistent with the actual secondary voltage and the true basic transformer ratio for that system.

The present confusion in such an elementary yet widely misunderstood subject points up studies of preferred voltage ratings now being made by joint industry technical committees. By seeking to clarify the origin and significance of commonly-used system voltages and transformer ratios this article seeks to promote a wider understanding of what has come to be regarded as a confusing situation.

Early Ratios

Since the building of the first transformer by William Stanley in 1886, the idea of voltage standardization has been in evidence. Early Stanley type transformers had such voltage ratings as: 1,000/50, 1,000/100, 1,150/115, 2,000/100 and 2,300/230 —turn ratios of 10/1 and 20/1. As distribution systems began to expand from 1890 to 1900, commercial transformers continued to use these ratios. Commonly used transformers of the period had voltages of 1,040–52/104, 1,040–104/208, 2,080–52/104, 2,080–104/208, 2,100–105/210, 2,300–115/230, 1,100/2,200–110 and 1,200/2,400–60/120.

While the early 20/1 ratio transformer was becoming a recognized standard, higher voltage units were also being developed. Electric railways contributed much to the introduction of 6,600 volts and 11,000 volts so that at the turn of the century voltages of 2,200, 6,600 and 11,000 volts were generally recognized as "standard" for three-phase, three-wire systems.

Based on Lamp Voltage

During this time the incandescent lamp had been developed on the basis of a 110-volt rating so that the transformer ratings for these higher voltages became 6,600–110/220 and 11,000–110/220, ratios of 60/1 and 100/1 respectively. A voltage of twice 6,600 volts (13,200) also came into general use and lighting transformers were rated 13,200–110/220 a ratio of 120/1.

Early in the century transmission and distribution voltages in common use were 2,200, 4,400, 6,600, 11,000, 13,200, 16,500, 22,000 and 33,000 with 44,000 and 66,000 volts beginning to appear. Utilization voltages gradually became standardized at 110, 220, and 440 and 550 volts for lighting and power service.

The above references are to three-phase, three-wire systems, i.e., ungrounded systems or systems grounded at the source only. They might be called "basic" systems.

The merits of three-phase, four-wire systems were early recognized and many of the first 2,200-volt distribution systems were wye-connected. This resulted in a voltage rating of 2,200/3,810 volts. It is important to recognize that the three-phase, four-wire system is a *derived* system that not only retains the voltage of the "basic" delta system (phase-to-neutral) but offers an additional or *derived* voltage that not only retains the voltage of the "basic" delta system (phase-to-neutral) but offers an additional or *derived* voltage (phase-to-phase), 1.73 times the basic voltage.

During the more than fifty years of development of transmission and distribution systems, there has been a constant trend toward higher voltages limited only by developments in methods and equipment consistent with economic considerations. The higher voltages have quite generally been obtained by the wyeing of previous voltages or doubling or using even multiples of those in common use. There is every good reason for such practices when higher voltages are required, as wyeing often permits the use of present transformers without change and doubling the voltage often is possible because of series-parallel transformers already in service.

Diverse Nomenclature

While the establishment of higher voltages has followed fairly definite patterns, confusion has often arisen because of the lack of uniform nomenclature in referring to various voltages. In many cases this has resulted in the purchase of improper voltage taps and ratios. This is particularly true of the distribution voltages below 15,000 volts and, to some extent the higher voltages as well.

Several factors contributed to the confusion:

(1) A "looseness" in referring to the nominal voltage of a system.

(2) The fact that wye connected systems may produce "derived" voltages (phase-to-phase) that closely approximate well established delta voltages.

(3) The gradual change over the years from a 110-volt base to a 120-volt base with these changes being made by different companies at irregular intervals.

Classification of distribution systems in terms of the basic ratio of the transformers that they serve—in the manner of the accompanying table—is a means of avoiding errors in distribution transformer application.

The accompanying classification tabulates basic ratios of transformers for most systems in common use when related to base secondary voltages of 110, 115, and 120. It is of the greatest help in the lower voltages where transformers step down to utilization voltages—and when connected on their full winding, express the true ratio of the system. For the higher voltages, the basic ratios are the same as for potential transformers which the system would ordinarily use.

Traces Voltage Ratings

From the table it is easy to trace the successive voltage ratings of distribution transformers throughout the life of the utility industry.

By 1900, for example, voltages of 2,200, 6,600 and 11,000 were generally recognized as standard. With the increase in secondary voltage ratings to 115 volts these transformers were re-rated 2,300, 6,900 and 11,500 volts. But *their ratios were unchanged.* The change to a 120-volt base brought ratings of 2,400, 7,200 and 12,000 volts. *No change in the ratios of these transformers has ever been made since they were established nearly 50 years ago.*

It has been pointed out that wye connected systems may produce "derived" voltages which closely approximate well established delta voltages. Take, for example, the original 6,600-volt, three-wire, delta-connected system. This was also connected three-phase, four wire, wye, yielding a "derived" system rated 6,600/11,430 volts. This has been loosely called an 11,000 volt system, although it obviously does not produce the same phase-to-phase voltage as the 11,000 volt delta system. The former has a ratio of 11,430/110 or 103.9/1, while the 11,000 volt delta system has a ratio of 100/1. In some cases transformers rated 100/1 were used for phase-to-phase connection and the utilization voltages obtained, while not consistent with 60/1 ratio phase-to-neutral transformers, were reasonably satisfactory.

The same situation exists today with the voltage ratings changed to 6,900/11,950 and 7,200/12,470. A transformer rated 11,500/115 or 12,000/120 volts will not deliver the same voltage when connected phase-to-phase on a 6,900/11,950 or 7,200/12,470 volt system as will a 60/1 transformer connected phase-to-neutral, although it may be satisfactory even though some four percent higher.

Some Ratios Changed

In a few instances, companies changing to a 120-volt base actually changed transformer ratios. For example, 6,600/110--volt transformers were first re-rated to 6,900/115 with no change in ratio. Subsequently, some companies requested ratings of 6,900/120 volts—a new ratio of 57.5/1. Likewise, the original 13,200-volt transformer was rated 13,200/110 volts, a ratio of 120/1. This later was re-rated 13,800/115 volts with no change in ratio. In 1930, however, a new standard transformer was established with a voltage rating of 13,200/120 which was, of course, an entirely new ratio of 110/1.

Simultaneously, a new transformer was introduced having a rating of 7,620/120 volts, a ratio of 63.5/1, suitable for connecting phase-to-neutral on a three phase, four-wire, 13,-

A CLASSIFICATION OF TRANSMISSION AND DISTRIBUTION VOLTAGES with respect to BASIC RATIOS OF TRANSFORMERS

This table shows the more commonly used voltages. No attempt has been made to include all of the voltages now in use or to suggest preferred voltages for future use.

Nominal Voltages for Various Secondary Bases			Type of Circuit		Equivalent Transformer Ratio		
110V	115V	120V	Phase	Wire	Ph-to-Ph	Ph-to-Neut	Remarks
110	115	120	1	2	-	-	Utilization voltage Also 3w120/240v. etc
190	199	208	3	4	-	-	Most commonly used for low voltage networks
220	230	240	3	3	2/1	-	Common voltage for small power loads
440	460	480	3	3	4/1	-	Industrial power and secondary power distribution
550	575	600	3	3	5/1	-	Common for mining and textile industries
1980	2070	2160	3	3	18/1	-	Limited use Do not confuse with 20/1 ratio
3440	3590	3740	3	4	31 1/1	18/1	Transformers rated 3740/120v rarely used
2200	2300	2400	3	3	20/1	-	Probably most commonly used ratio
3810	3980	4160	3	4	34.6/1	20/1	Transformers rated 4160/120v used occasionally
4400	4600	4800	3	3	40/1	-	Obviously, two times the 20/1 ratio
7620	7960	8320	3	4	-	40/1	Transformers rated 8320/120v not available
6330	6610	6900	3	3	57.5/1	-	Limited use Do not confuse with 60/1 ratio
10950	11450	11950	3	4	99.6/1	57.5/1	Ratio of 100/1 used rather than 99.6/1
6600	6900	7200	3	3	60/1	-	Three times the 20/1 ratio
11430	11950	12470	3	4	-	60/1	Transformers rated 12470/120 (103.9/1) not avail.
10090	10550	11000	3	3	91.7/1	-	Very limited use Do not confuse with 100/1 ratio
11000	11500	12000	3	3	100/1	-	Five times the 20/1 ratio
8980	7300	7620	3	4	-	63.5/1	Ratio of 63.5/1 used only ph-to-neut
12100	12650	13200	3	4	110/1	63.5/1	Ratio of 110/1 established in 1930
12650	13225	13800	3	3	115/1	-	Limited use Do not confuse with 110/1 or 120/1 ratio
13200	13800	14400	3	3	120/1	-	Six times 20/1 ratio Do not confuse with 110/1 ratio
15780	16500	17200	3	3	143/1	-	Very limited use Originally one half 300/1 ratio
19000	19900	20800	3	3	173/1	100/1	Derived from wye connection of 100/1 ratio
22000	23000	24000	3	3	200/1	116/1	Ten times the 20/1 ratio
26400	27600	28800	3	3	240/1	139/1	Obviously twice 13200, 13800 or 14400 volts
33000	34500	36000	3	3	300/1	173/1	Fifteen times the 20/1 ratio
38100	39800	41600	3	3	346/1	200/1	Derived from wye connection of 200/1 ratio
44000	46000	48000	3	3	400/1	231/1	Twenty times the 20/1 ratio
55000	57500	60000	3	3	500/1	289/1	Twenty-five times the 20/1 ratio
66000	69000	72000	3	3	600/1	346/1	Thirty times the 20/1 ratio
88000	92000	96000	3	3	800/1	462/1	Forty times the 20/1 ratio
95300	99600	103900	3	3	866/1	500/1	Derived from wye connection of 500/1 ratio
110000	115000	120000	3	3	1000/1	577/1	Fifty times the 20/1 ratio
132000	138000	144000	3	3	1200/1	693/1	Sixty times 20/1 ratio
154000	161000	168000	3	3	1400/1	808/1	Seventy times the 20/1 ratio
220000	230000	240000	3	3	2000/1	1155/1	One hundred times the 20/1 ratio
275000	287500	300000	3	3	2500/1	1443/1	One hundred twenty-five times the 20/1 ratio

200 volt system. Here was the operation of "derived" voltage in reverse whereupon the phase-to-neutral voltage was determined *after* the phase-to-phase voltage was established.

These ratio changes have caused much confusion in this voltage class of transformers. The new 110/1 ratio could not properly satisfy the requirements of the well established 120/1 ratio system, therefore, transformers of 120/1 ratio were still in demand. To add to the confusion, some companies decided to make still another ratio change and requested that the 13,800/115 volt rating (120/1 ratio) be changed to 13,800/120—another new ratio of 115/1. It is apparent, and the table readily shows, that there are now three separate and distinct ratios in this voltage class—110/1, 115/1, and 120/1. It is unfortunate that this situation has developed, but to allow it to continue would be even worse. Fortunately, what actually occurred is now being recognized and an attempt is being made to arrive at a solution which will result in fewer ratios, if possible.

Further comment on the table is hardly necessary as the remarks following the various voltages indicate their almost obvious origin. The relationship of many of these voltages to the original 20/1 transformer ratio has no particular significance other than to show that, regardless of the name given to a particular transmission or distribution system, it is quite generally the legitimate offspring of some well established voltage.

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Atavism in English Lighting

Glare, the prime abhorrence of the illuminating engineer and the principal characteristic of electric lighting in the early days, is returning to the scene in England, according to the Lighting Service Bureau of London. With electricity for lighting in commercial places restricted to 1½ watts per sq. ft. of floor area, lamp enclosures are being removed so that all light produced may shine unimpeded. The harsh quality of raw light thus enforced by war conditions demonstrates how far the electric lighting art has progressed from its crude beginnings and builds greater appreciation of modern illumination practices.

Two-Shot Reclosers Reduce Rural Outages

Reclosing cutouts materially reduce transformer outages; rural customer interruptions and travel minimized—applicable for areas of frequent lighting and unfavorable grounding

EDWARD A. RUCH, JR.,* Public Service Electric & Gas Company

PUBLIC SERVICE Electric and Gas Company made a trial installation of "two-shot" reclosing cutouts on transformers during 1942 in an area where, in the past, excessive fuse operations had occurred during lightning storms. This area, which lies along the edge of the Sourland Mountains in Somerset and Hunterdon Counties of New Jersey, is approximately twelve miles from the distribution headquarters. It is supplied by a 2400-volt, 2-wire branch of a 4,150-volt, 3-phase, 4-wire circuit. The transformers, which vary in size from 1 to 10 kva., are all fused with 10-amp. fuses. In general, each transformer supplies one or two customers, and there is, therefore, very little secondary construction (Fig. 1).

This circuit was converted to multi-grounded operation during 1943. Prior to that year, the lightning protection consisted of 3-kv. lightning arresters connected on the transformer side of the fuses and a secondary gap arrester between secondary neutral and lightning arrester ground. The primary neutral arresters and secondary gap arresters have now been removed. Customers' grounds are usually driven grounds, although a few have been connected to well casings on the premises. This is because there is no municipal water supply in the vicinity. Both of these grounds are of questionable value. Since the driven grounds, measuring from 50 to 230 ohms, are so poor, the primary phase arrester was left on the transformer side of the fuse.

Records covering a number of years show an average of 28 fuses blown per year in this area. Replacement of these fuses required from 400 to 600 miles of automobile travel. It was often necessary to make several trips to the area during an electrical storm to re-fuse cutouts.

In the spring of 1942, it was decided to make a trial installation of 50 "two-shot" reclosing cutouts on the transformers, on the portion of the circuit farthest from headquarters, where the largest number of transformer fuse operations had occurred. An open-link type, "two-shot" cutout without time delay was selected rather than one with time delay for two reasons:

1. No time delay was required, because the protection sought was only that from the blowing of fuses by lightning surges. The addition of a time-delay mechanism, therefore, would have been only a potential source of trouble.

2. The "two-shot" cutouts without time delay were only slightly more expensive than the cutouts which were formerly used, whereas the one with time delay was much more expensive.

The cutouts which were installed consist of a porcelain tube, at the upper end of which are mounted two

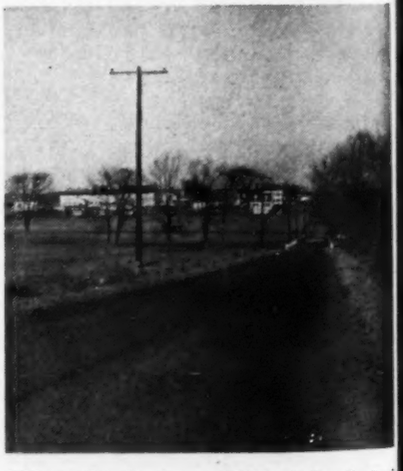


FIG. 1—Single-phase, 2,400-volt line in typical rural area protected by two-shot reclosing cutouts

* District Foreman, Trenton, N. J.

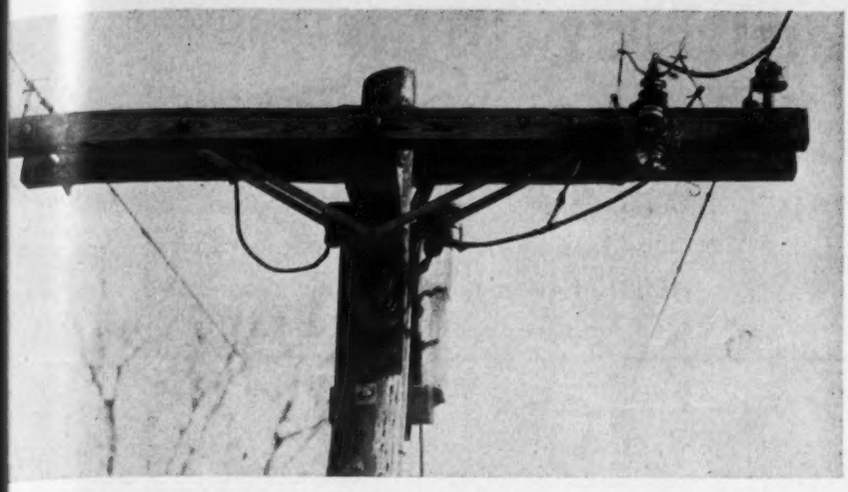


FIG. 2—"Two-shot" reclosing cutout in typical installation on 5-kva transformer

rigid arms for holding the upper ends of the fuses. These two arms are connected electrically. At the lower end of the tube are two pivoted arms, to which are attached the lower ends of the fuses. These arms are not connected electrically. The cutout is inserted in the circuit between the line and the transformer, by connecting the line lead to the two upper contact arms and the transformer lead to one of the lower contact arms. This places one fuse only in service. When a lightning surge causes this fuse to blow, the lower contact arm which held the blown fuse swings down under spring tension and makes contact with the lower contact arm holding the second fuse. This places the second fuse in the circuit, with an interruption to the customer of only a fraction of a second.

In order to prevent a momentary interruption to service at the time the blown fuse is replaced, a shunt is provided for connecting the lower two contact arms together. As soon as the fuse is replaced, the shunt is disconnected. If for any reason the lineman should forget to remove the shunt, no serious damage would result. It would merely mean that both fuses would be placed in parallel and at the time of the next fuse operation, both fuses would blow and the reclosing feature of the cutout would be lost.

The open-type reclosing cutout is limited in its use to single-phase primary lines in rural areas because of the difficulty in providing clearance from conductors on congested poles. This restriction, however, is not important since the principal use is on single-phase lines in rural areas. There the installation of the decidedly more expensive enclosed-type repeating cutout cannot be justified. By the use of the open-type repeating cutout, we have practically eliminated long trips to this outlying area to restore service during lightning storms. Now, after each electrical storm, the area is covered by a troubleman or line crew when working in the general vicinity and all fuses are replaced on one trip. This practice has not only saved considerable time, but also conserves gasoline and tires, which is a factor worth considering these days.

During 1942, 17 fuse operations occurred (Fig. 3). In only one case were both fuses blown. In that case, a defective lightning arrester was the cause. To replace the 17 fuses, seven inspections were made by line crews or troublemen, when working in the vicinity.

Marked reduction in customer outages (Fig. 3) during the 1942 storm season led to an extension of the trial installation in 1943 to 41 additional transformers. No service interruptions were experienced in that year on the entire installation at 91 locations, although the first fuse had blown on each of 22 transformers. Only four inspection trips over the area were made in that year, and as many as eight fuses were replaced on one trip.

The reduction in the number of fuses blown in 1943 is presumably due to the change of the primary circuit to multi-grounded operation. A typical installation of a "two-shot" cutout on a 5-kva. transformer is shown (Fig. 2).

The success of this trial of "two-shot" cutouts has led us to plan the installation of additional cutouts on other outlying portions of our territory. In addition, it is proposed to install this type of cutout at other isolated locations where repeated fuse blowings were experienced during lightning seasons in the past several years.

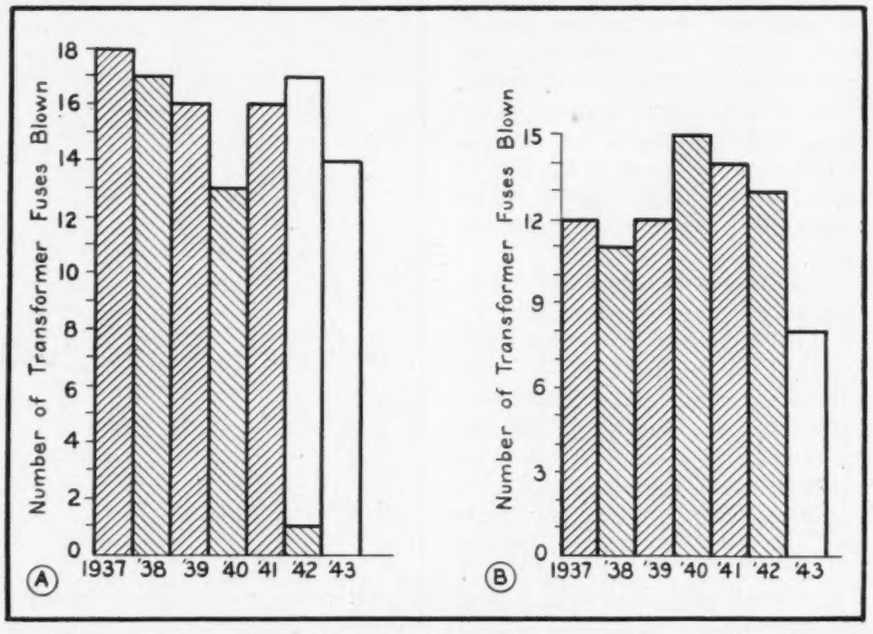


FIG. 3—Successive installations of "two-shot" reclosing cutouts show market reductions in interruptions when fuse blows. The cross-hatched areas indicate interruptions, the open areas no interruptions. A—First installation on 50 transformers in 1942; the sole interruption was due to both fuses blowing because of a defective lightning arrester. B—Second installation was on 41 additional transformers in 1943

Improved Coal Handling Features Devon Extension

Older and new section of plant co-ordinated mechanically and electrically—Operating economy favorable on base load production in connection with system hydros

RECENT EXPANSION of the Connecticut Light & Power Co.'s Devon steam plant from a rating of 75,000 kw. to 120,000 kw. to serve increasing war loads called for a greatly improved fuel handling system to supply pulverized coal to two new boilers, each delivering 225,000 lbs. of steam per hour to a 45,000-kw. 850-psi, 900-degree turbine generator. The initial installation at Devon (ELECTRICAL WORLD, March 22, 1924, page 562) was equipped with three 25,000-kw. turbine units operating at 285 psi., and steam was furnished by six 150,000-lb. per hour stoker fired boilers. Originally these boilers were supplied with coal coming by rail, but later facilities for handling water-borne coal were installed and today coal delivered by rail, water and truck can be handled to meet varied requirements. Both the older and new sections of the plant can be supplied with coal from any of three sources according to conditions, but in general water-borne coal is used, as the plant is located near the mouth of the Housatonic River on Long Island Sound with a tidal variation of about six feet.

In 1926 two boilers were added, each having an economizer, and two of the older boilers were also equipped with economizers. In 1940 provision was made to supply water-borne coal to Devon by dredging the channel to a depth of about 15 feet below mean low water and making arrangements for docking barges and unloading coal to the existing system.

The 1942 additional boilers were the first utilizing pulverized coal at the Devon station. Capacity and steam requirements made necessary a flexible fuel supply coordination between the older and the new sections of the station. It was found desirable to establish a centralized control point in the upper portion of the new boiler house from which all crusher and conveyor equipment could be governed by push buttons, with the usual automatic safeguards against backing up of coal in the event of a shutdown beyond any supply point. The enlargement of the boiler plant necessitated provision of wharf facilities, including a Link Belt speeder Whirley electric crane with a 50-ft. boom, 3-ton bucket and unloading capacity of 400 tons per hour. West Virginia slack coal is towed to Devon in 850-ton barges. Each of these is moored beside the wharf and held in place there by lines wound on drums driven by reversible a.c. motors. The barge hauling equipment is controlled from the cab of the unloading crane. To move the barge, the crane operator presses a button which operates one of the hoists in one direction and the other hoist in the opposite direction at reduced voltage. The lines are made taut and the barge "jockeyed" into place. The release of the operating buttons applies brakes to both motors, holding the barge firmly in place for unloading.

From the unloading crane the coal

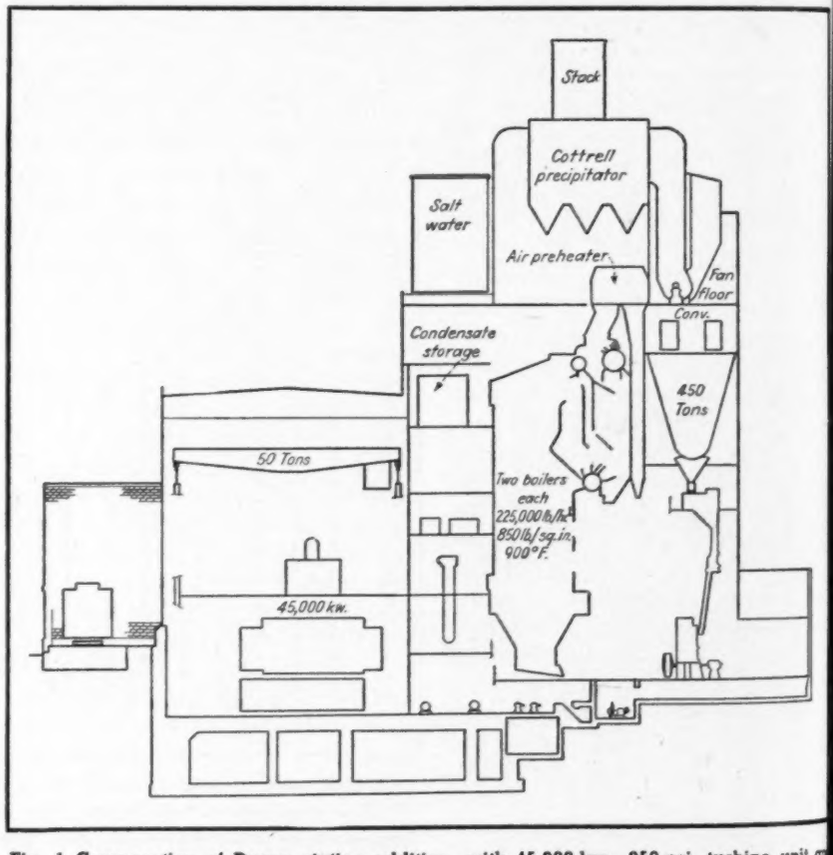
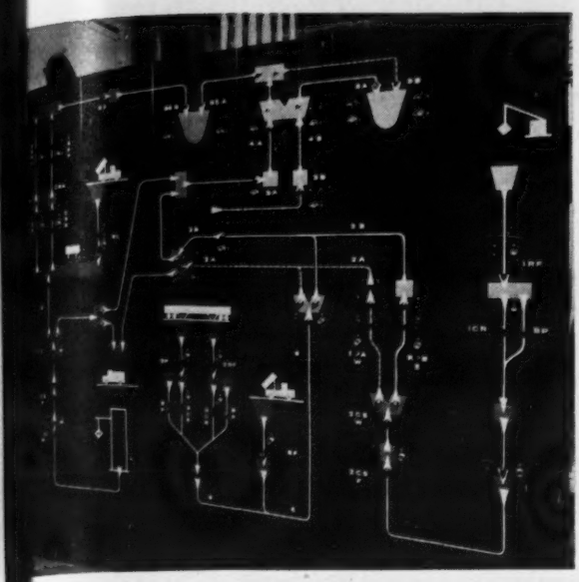
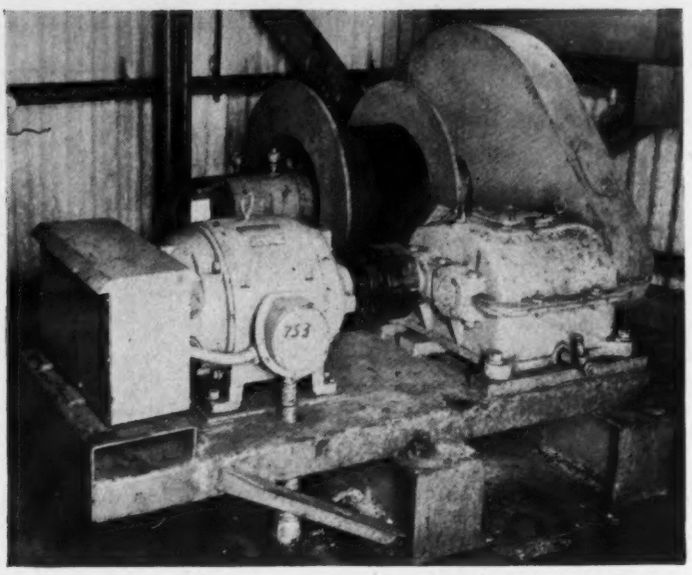


Fig. 1 Cross-section of Devon station addition, with 45,000-kw., 850-psi. turbine unit and pulverized coal burning boiler installation





G. 2—Control board (left) for coal-handling system governs operations of old and new sections of plant. Supply of fuel flexible with terlocked protection of motor drives in case of failure at any point in coal flow. Winch equipment (right) in process of installation to guide barges and maintain their position while unloading at wharf

discharged into a 35-ton receiving pper and from there (Fig. 3) it is livered by a rotary feeder (1RF) a crusher (1CR). A bypass (BP) provided at the crusher. It then sses by belt to a set of Richardn coal scales (2CSW) with a pacity of 400 tons per hour. From ere it is discharged through a rotary eder to belt 2B (provision has been ade in the design for the future inllation of a second belt 2A and sociated rotary feeder). Belt discharges coal to a junction wer, whence it is delivered either a hopper and then to trucks for nsferring to yard storage and later clamation, or to Belt 3A and Belt to the upper part of the boiler use. Transfer is made at this point Belt 5A leading to the bunker of tons capacity above the new lers. An alternate delivery from transfer point named above is Belt 55A to the bunkers in the er section of the station. This will handle 125 tons per hour.

Another improvement made in the l handling system was to equip existing railroad trestle with two track hoppers, complete with rotary feeders, crushers and bysses. These discharge upon Belt 6 then to Belt 2B, providing full acity coal delivery by rail. Coal laimed from the yard storage can be discharged from trucks into opper from which a feeder conion is made to Belt 6 and so to the n system Belt 2B. In emergencies coal can be reclaimed by a rotary crane from the yard, and a crawler crane is employed for normal yard reclamation service. Coal, discharged by truck, is usually stocked in the yard to a height of about 25 ft. and is thoroughly rolled.

The older section of the coal handling plant is also controlled from the fuel governing center mentioned above. This section has a capacity of 125 tons per hour. Coal can be delivered from a conventional unloading tower at a barge berth to a junction tower and thence via automatic scales ICS-W to feeders 11 and 12 (Fig. 3). From feeder 12 delivery is made to a track hopper (with rail delivery provision to this receptacle) and thence by crushers CRA and CRB to skip hoists 1 and 2, leading in turn to rotary feeder RF and by Belt 55B to the older boiler room bunker equipment. Belt 11 delivers coal via a junction tower to a truck hopper for yard storage, or to Belt 3A for ultimate discharge into either the older or new boiler house bunkers. All junction points are equipped with automatic control devices to stop

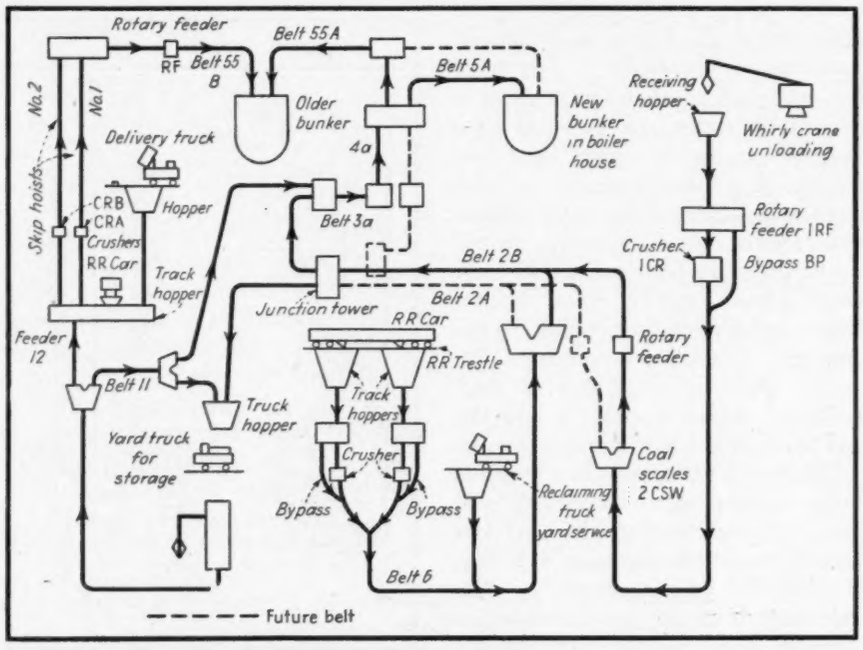


FIG. 3—Schematic diagram of coal-handling facilities

motor drives ahead of them in case of trouble. Certain junction points are provided with electric vibrators to facilitate the movement of wet coal, and exposed hoppers and chutes are provided with electric heaters to prevent freezing of coal. Belts are also equipped with 500-watt strip heaters mounted 1½ in. from the return side of the belt. These heaters are connected so that in case a belt drive motor stops the heater is cut off in order not to injure the belt while standing still. Pilot lights indicate the routing of coal flow at all times on the control board of the boiler house. About 100 kw. of vibrators and strip heaters are employed.

While the coal handling system is versatile in providing fuel delivery by rail, barge or truck, a number of pertinent features in the plant may also be mentioned. In the extension the original plan of connecting the generating units directly to step-up transformer banks outside the building was followed to advantage. Generation is at 13.8 kv. Each generating unit has its own transformer bank (25,000 kva. for each of the original three 25,000-kw. units and 50,000 kva. for the 45,000-kw. machine).

Boiler and Turbine

The new boilers are by Combustion Engineering with dry bottom furnaces, each with 5,345 sq. ft. of water wall area and boiler heating surface of 15,300 sq. ft., and one 40,800-sq. ft. Ljungstrom air heater and Cottrell precipitator per boiler. Ash from furnaces and precipitator hoppers is sluiced by water and pumped to a shallow bay near the plant for filling the site of a future extension of coal storage facilities. Each boiler is provided with one 65,000-cfm. forced draft American Blower fan with vane control and constant speed electric drive and hydraulic coupling speed control. A stub stack was furnished as no appreciable increase in draft could be obtained with the 350-deg. gas temperature prevailing normally.

The turbine generator is a Westinghouse condensing unit running 3,600 rpm., hydrogen-cooled (2.5 psi) and having extraction points at 311, 169, 77, 24 and 5.6 lb. absolute. The generator is of the new flexible suspension type, making it practically free from 120-cycle vibrations. The

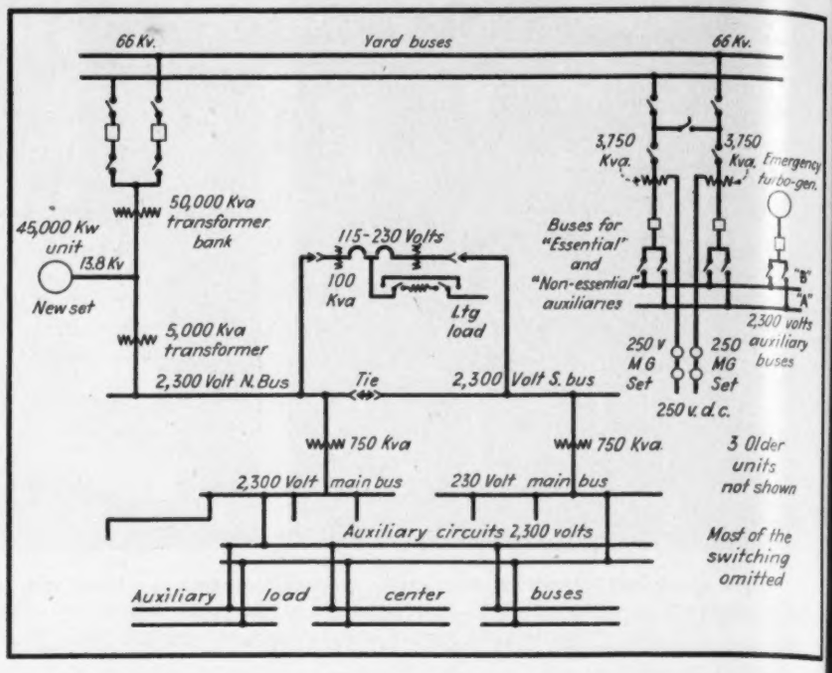


FIG. 4—Elementary diagram of main connections and auxiliary power supply for new unit and part of older station, omitting older turbo-generators and some switching

design of the foundation was simplified by employing a fabricated steel structure without concrete encasement, increasing the accessibility of the unit. Condensate is normally stored under full vacuum below the condenser (30,000 sq. ft., cooling water range 34 to 80 F.) and this tank serves as the normal operating surge tank. The capacity is such that the boilers may be filled without the use of the emergency tanks provided in the boiler house extension, 72 ft. above the circulating pump floor. Make-up is treated with phosphate, sulphite and caustic on a continuous basis. A condenser deaerating hot well is provided and tests indicate that the boiler feed water is maintained with only a trace of oxygen. With one boiler shut down, 25,000 kw. output can be readily obtained from the new turbine unit. Two boilers provide flexibility, high turbine use factor, and easy operation at partial loads. A feature of the

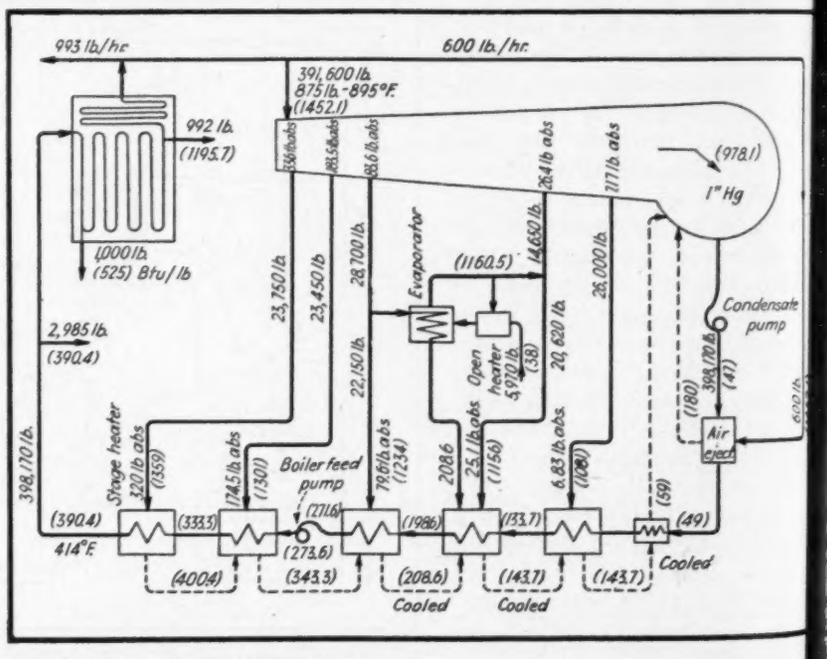


FIG. 5—Heat balance diagram for new unit

extension was the construction of a new circulating water intake with sufficient capacity for an ultimate installation of 200,000 kw.

Booster Pumps Eliminated

In the heat balance five stage heaters are connected in series with bleeds as shown. No booster pumps were required. The condensate pump passes the feed through the first three stage heaters, and feed pumps through the last two and into the boilers. Make-up passes through an open heater into an evaporator connected with the fourth stage heater, and the usual provisions have been made for reclaiming Btu. in various drips and coolers. Simplicity and dependability were stressed in the layout.

Electrical Layout Straightforward

Simplicity and dependability were also sought in the electrical layout of the addition. The new generator (13.8 kv. and 45,000 kw.) is connected directly to the primaries of the 50,000-kva. transformer bank without intermediate switching facilities. The secondaries of the step-up transformers are connected to two 66-kv. buses in the station yard through disconnects and oil circuit breakers. From the 13.8-kv. generator leads, a connection is also made to a 5,000-kva. three-phase transformer, stepping down to 2,300 volts for station service bus use. The layout permits a breaker to be installed in the future to split this station service bus into north and south sections. All 2,200-volt switching equipment on the station service bus is of the metal clad type, with air break circuit breakers having 150,000-kva. interrupting capacity.

Essential Service Accented

From the 2,300-volt station service bus, connections are made through truck-type air circuit breakers to various motor-driven auxiliaries of primary importance, including two 150-hp. condensate pumps; two 200-hp. circulating water pumps; two 800-hp. boiler feed pumps; two 100-hp. salt water service pumps; two 100-hp. mill motors for each boiler; two 200-hp. forced draft fans and two 500-hp. induced draft fans. These auxiliaries are grouped on each section of the service bus so that 25,000 kw. may be generated with half of the bus out of service.

Each section of the 2,300-volt service bus is connected to a 750-kva., three-phase transformer of the air-cooled type, supplying a corresponding 230-volt main bus, from which auxiliaries driven by 230-volt motors are operated. These auxiliaries include equipment identified with the precipitators; motors driving coal handling equipment in the older and newer sections of the station; and connections to switch groups controlling various small boiler and turbine equipment. The use of double buses and supply for 230-volt auxiliary service provides continuity of operation.

Flexible Lighting

Provision has been made on the new layout for a highly flexible supply of lighting loads at the station. In general, these may be fed alternately through truck type switches and groups of 100-kva., 230-volt air-cooled lighting transformers, supplied optionally from either the north or the south 2,300-volt station service bus. To facilitate regulation on the lighting circuits, 10 kva. dry type 10 percent buck-and-boost single-phase regulators have been installed in the main lighting load supply circuits, with provision for by-passing these regulators by double-throw disconnects.

During starting periods the new 2,300-volt auxiliary bus is energized from the "non essential" bus in the old station. When the new 45,000-kw. unit is in service and power is available from the auxiliary transformer on the generator leads, the power supply to the auxiliary bus is quickly transferred from the starting source by means of interlocked air circuit breakers. This scheme has been very successful and eliminates the hazard of possible interconnection between the two station service power supplies.

When the new unit is operating on base load at 45,000 kw., its economy runs between 11,200 and 11,600 Btu. net per kilowatt-hour.

The addition was constructed by the United Engineers & Constructors, Inc., and engineering was done jointly by the same company and the engineering staff of the Connecticut Light & Power Co.

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Use Aerial Switching at Three-Way Junction

By R. L. DODD

Wisconsin Electric Power Company, Milwaukee, Wis.

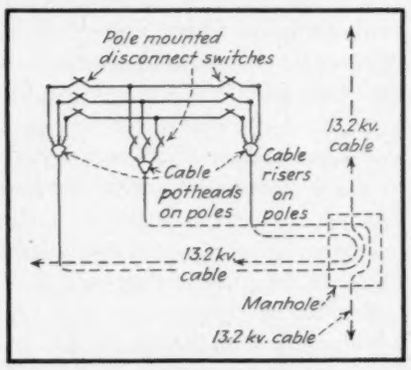
Illustrated is a three-way aerial switching arrangement resorted to on the underground sub-transmission system of the Wisconsin Electric Power Company in Milwaukee to provide switching flexibility at low cost in an instance where a 13.2-kv. cable tapped an existing "trunk" feeder cable.

The tap was made in an existing manhole which was too small to allow oil-filled disconnect switches to be installed without enlarging it at considerable expense. However, by bringing cable risers out of the manhole to the special pole structure near by and mounting air-break switches thereon, a switching arrangement was provided which has proved rugged, reliable and somewhat cheaper in cost than the alternate arrangement.

This switching arrangement makes it possible to isolate any of the three legs of the T formed by the tap and the main feeder cable.

Interrupting duty imposed on the air-break switches is not severe. They are called upon to break the charging current of one or two miles of cable at the most.

Three 40-ft. poles, set on 6 and 9 ft. centers, make up the structure. Three-pole air-break switches of the conventional horizontal type were mounted on the end poles. To keep pole spacing down a vertical switch was used on the center pole, which has its blades opening to the side. Leads to this switch were led down from a short bus extending between the two end switches.



SCHEME of switching arrangement

Editorials

S. B. WILLIAMS, *Editor*

Olive Branches

EVERY SO OFTEN we hear of olive branches being offered to the utility industry by those who have been active in opposition to private operation. Because so many times in the past an olive branch has been but a screen for further harassment is the industry going to say "no, thank you"? That might be the first inclination, and it would be understandable, but can the industry afford to ignore any such offer?

There were definite indications, for instance, in the speech this week by Chairman Olds before the New York section, A.I.E.E., that the Federal Power Commission would like to find some way of removing the unfriendly barrier that has grown up between it and the industry it was set up to regulate. Mr. Olds said that the post-war era will call for the greatest co-operative effort in history and pledged that "we of the regulatory bodies will co-operate."

Regardless of what has happened in the past this is certainly a bid for team play that calls for the exercise of all the diplomatic talents of the utility industry to try to make it work. No one can deny that the utilities will be much better able to make their contribution to an improved post-war economy of this country if something like the same atmosphere could prevail between them and the Federal Power Commission as exists between the railroads and the Interstate Commerce Commission.

It is a sad thing indeed when a business mistrusts every move of its regulating agency. Perhaps the industry has been remiss in not making more efforts to understand what the commission was trying to do, but surely it is equally a responsibility of the commission to want to know the mood and temper of its industry. Statistics are essential to a knowledge of financial transactions but regulation that relies entirely on such cold data appears devoid of the understanding that would inspire greater faith in the commission's integrity of purpose.

Regulatory commissions may truly believe that they are administering their jobs with just as much regard for the welfare of the industry as for the public, but if they take what appears, both in spirt and letter, to be a harmfully biased position the industry can hardly be criticized if it mistrusts the commission's motives.

A commission should have the confidence and respect of the industry it regulates and the two should be able to work together in perfect harmony without in any way diminishing the public protection.

Can this be accomplished now? Perhaps not completely, but certainly a start can be made. If two nations, after a long period of bloody fighting, can adjust their differences and work together, cannot diplomacy and understanding effect some degree of reconciliation between the commission and the industry? The scars of battle may never disappear, but surely the wounds can be healed.

Rapid Extension of Farm Electrification

ONE OF THE post-war markets that is slated for immediate attention is rural electrification. To make service available everywhere new lines will be needed, it is estimated, to serve something in excess of a million and a half farms which at a density anywhere near two to a mile would mean between a half and three-quarters of a billion dollars in new construction. Besides, there are some 400,000 farms within reach of existing lines which should be connected.

Add to this amount required for line construction and customer connection the cost of farm wiring and appliances, and one finds a tidy sum of money to be expended and in a comparatively short space of time. There is some discussion that most of this extension work might be completed in as short a space as the first five years after the war.

Where a few years ago utilities were loath to expand their rural service into thinner territory because it wasn't paying out even in denser areas, now the policy seems to be to take the business anyway and find some way to make it pay. Had this more progressive policy been in force a few years ago the utilities might have been spared many of their present worries.

Now that the utilities are coming to this decision they necessarily assume the obligation of helping the farmer secure the advantages of electric service as far as possible. The national average farm use of electrical energy is not known because of the manner of reporting. Whatever it is, it can be greatly increased by strong promotion of actual farm uses.

Some estimate that the average farm use can be made to exceed 5,000 kw.-hr. a year. If that is a goal to shoot at, much more must be known about farm utilization than is known at this time. The size of the market and the need for speed would seem to indicate that co-operative attention to the farm market was in order. Manufacturers

agricultural engineers and utilities working together could do much to advance farm electrification. Some organization, but going further than the Committee on Relationship of Electricity to Agriculture (CREA), is needed at this time.

Load Builders Not Overawed by Peacetime Problems

LAST WEEK the annual commercial conference of the Edison Electric Institute drew the largest attendance in its history. Why did two to three times as many people go to Chicago for the series of meetings as used to go five or six years ago? That question was asked many times during the conference and the answer seemed to be that the commercial people were looking for help. They wanted to know what kind of plans the other fellows are preparing. How are they going to meet competition? What kind of sales training programs are being discussed? How much load can be added in the near post-war period? What will happen to the industrial load?

While these and a host of other questions were in the minds of those who went to the Chicago meetings, it doesn't necessarily mean that commercial people do not know where they are headed or have any plans. On the contrary, a great many do have plans that have been worked out in great detail, some of them down to that final figure in the lower right-hand corner. But since this is planning time the conference offered a splendid opportunity to check with others and to learn of ideas that might be incorporated.

While there are still many companies that have not worked out their plans, one got the feeling that by and large the utility commercial men were by no means overawed by the size of the post-war sales jobs. They are not underestimating the problems that are ahead but they are confident of their ability to build load faster than they have ever done in any prior peace-time period.

Fluorescent Lighting's Greatest Problem

ONE BY ONE lamp manufacturers are eliminating the causes of dissatisfaction with fluorescent lighting, the latest being the announcement of instantaneous starting, but the thing that will hold back relighting more than anything else remains unsolved—a practical means of maintenance.

While this is something to cause concern to manufacturers, it isn't so much their problem as it is the utilities, because it has to do with the customers' getting the best use of their service.

The bulk of the maintenance problem is the simple little job of cleaning the fixtures so that the customer will get all the light he is paying for. It isn't difficult, but it isn't something that should wait until somebody remembers it.

Among the suggestions that have been made is the contracting for maintenance at the time of sale. That works fine when the number of sales is small, but it is apt to be unsatisfactory when the volume increases. Another suggestion that seems to have some merit is the employment of window-washing contractors on a schedule.

Since one of the difficulties is to know when cleaning is needed, perhaps a way can be found to install in the factory superintendent's office a foot-candle meter dialed to indicate when it is time to clean in any bay.

At any event, here is fluorescent's number one problem which is crying for collective attention.

The Problem of the Small Industrial Customer

IN VIRTUALLY every city the utility company representatives are conferring with other local business men on community post-war plans. This top planning under the auspices of the Committee for Economic Development is striking evidence of the close identification of the electric utilities with the interests of the areas they serve.

The greatest problem which most communities face is the preservation in the first mad rush for post-war business of the small manufacturing businesses that have been turning out war work. Many, if not most, of the concerns got into war work through the help of the local utility. That was easy, however, compared to getting back into civilian production.

The large manufacturers have sales forces and sales plans and during the war they have continued to maintain a certain amount of contact with their old customers. The smaller outfits, on the other hand, have in many cases lost these contacts and, because they have been too busy with war work to think of the future, they have no plans.

The power salesmen who sat down with small industrial customers to find out what they could make that Uncle Sam could use must now do the job all over again in reverse. Most of these smaller outfits will have no plans when they lose their war business unless the power salesmen help them.

Just as the first step in seeking war business was an analysis of the factories' equipment and special talents, so will it be necessary to make a similar study for civilian business. What equipment does the factory have, how many employees, what kind of work can it do, what kind would it like to do and how much can it do? The initial approach is the filling out of the CED check sheet for post-war employment. If every utility were to make it a responsibility of its power sales organization to see that every industrial has filled in one of these check lists the background would then be available for helping those customers who have no post-war marketing plans.

Washington Comment

By R. N. LARKIN, Washington Correspondent

Utility Manpower Outlook Clearer

THE ELECTRIC utility industry's manpower outlook is clearer this week than it has been for some months, and at the same time, distinctly improved.

The picture is improved not because the industry has been given any preference it did not previously have, but solely because, for one reason or another, the majority of key employees of electric systems are 26 or more years old. Insofar as there are key employees under 26, the manpower system is darker than ever.

Under the clarification of Selective Service policy and regulations which have been hammered out in Washington over the last several weeks, the emphasis is heavily on men under 26, so heavily on them that only a handful of physically able men below that age will remain in civilian life. That handful will be spotted meticulously in specified industries, of which the electric industry is not one.

Over 26 Age Groups

To the extent that men under 26 do not fulfill the needs of the armed forces, men 26 through 29 will be relied upon to close up the ranks of fighting men. Should these prove insufficient, the emphasis will fall on men over 29, presumably first upon those 30 through 33. The very absence of a specifically defined age class beyond 29 indicates that, momentarily at least, it is not expected that these men will be drawn upon to the extent they have been recently.

Government men who know the power industry say there are very few key electric utility employees below 26. If the present drive for young fighting men is extended to the 26 through 29 age group on anywhere near the drastic basis it has been applied to the 18 through 25 bracket, these men say, the electric power industry will be "hit a fair amount, sporadically, badly in some places, not so badly in others." Extend this same drive to the 30 through 33 age group and the power industry would be "hit all over, very heavily," they declare. Possibly if the draft were to be pushed as heavily beyond the 33-year-olds, these men go on, the electric industry would not suffer so badly as in the 30-33 group, but the losses would be severe. The effects of the drive for inductions under 26 will be felt most severely on small systems, the belief runs, simply because larger systems are apt to have several men who can perform vital technical work whereas the smaller systems are apt to have only one.

Less Strict Over 30

All this does not mean that men over 30 are to be immune from the draft. It does mean that men over 30 who are in an essential industry, of which the power business is one, will get preference over men under 30 who are in essential industry or over men of the same age not in essential work.

Selective Service, in a recent memorandum to local draft boards, ordered that no physically qualified registrant under 26 be deferred occupationally unless specifically approved by the State or National Director; that the "necessary man" qualifications of any fit registrant 26 through 29 be "strictly applied," relative to occupational deferment; and that the "necessary man" qualifications of a fit registrant 30 years or over "be less strictly applied with the increased age of the registrant." It added:

"Fathers, ages 26 through 29, if other factors are equal, will normally be accorded occupational deferment in preference to all non-fathers. Fathers, ages 30 and over, if all other factors are equal, will normally be accorded more liberal consideration for occupational deferment than fathers under the age of 30 and non-fathers."

From all this it is obvious that age has now replaced the numerous earlier qualifications for deferment in importance. The establishment of a few critical industries—high-octane gasoline, radar, rubber, rockets, landing craft, secret weapons and some others, as the only industries now sufficiently important to claim physically fit men under 26—is proof of the willingness of the armed services to sacrifice war production for warriers. It is important that electric utilities realize that their current good fortune is due solely to the age of their key men and not to any vital quality of the service they render.

Restricted Induction After June

Between now and July 1, about 500,000 men will be needed to bring the services up to full strength. Thereafter, replacements are expected to run between 100,000 and 125,000 men monthly until the European war has been won. At that time, many observers agree, inductions may be restricted to those boys who reach 18 each month.

By the time this reaches print, the special committee which is picking out industries and plants which may keep specified, irreplaceable key men under 26, will probably have completed its job. Thereafter, the age group under 26 will be cleaned out. While this goes on, the committee will make a similar, though somewhat less drastic survey of the 26-29 age group and this group will start to move out. If these moves fail to bring the services up to strength and, along with about 60,000 new 18-year-olds monthly, keep them there, the men over 30 will come in for similar treatment.

One part of the picture reflects limited but unqualified promise for the industry. Whatever else may be done with the nation's 4F's, they certainly will not be pulled out of the power plants and sent into labor battalions, or treated as Congress may otherwise dictate into the legislation on 4F's it is now considering. Since he operates an essential industry, the power producer who hires a 4F need fear only a lowering of the physical standards. This the recent committee to consider the matter refused to do, despite Congress' eagerness to exempt fathers.

NEWS OF THE WEEK

Regulators Draw Pattern for Post-War Expansion

Leland Olds and Milo Maltbie at New York A.I.E.E. meeting outline the rate and managerial philosophy which will win the favor of state and federal authorities

Co-operation of regulatory bodies was assured in New York on April 11 to the utilities by Chairman Leland Olds of the Federal Power Commission if they would lead all participants in private enterprise into realization that theirs is a trusteeship. Governmental regulation, he asserted, will become less and less necessary as self-regulation becomes the moral objective. The occasion was a heavily attended forum on "Power After the War" arranged by R. T. Oldfield, chief electrical engineer of the N. Y. Public Service Commission and chairman of the Power group of the New York Section of the A.I.E.E. The other contributors were Chairman Milo Maltbie of the P.S.C., John C. Parker, vice-president of Consolidated Edison and Judge Gay H. Brown of New York.

Program of Competitive Rates

Chairman Olds subscribed heartily to the program of resorting to competitive rates to induce the 50 billion and more kw.-hr., of consumption needed to offset the prospective decline in industrial usage. An objective of 200 to 220 billion kilowatt-hours at the point of generation for the end of the first post-war year and one of about 270 billion by the end of the fifth year was set by Mr. Olds not as a forecast but as a goal. He urged a critical study of every rate structure and every expense sheet to detect where the trimming could be applied. The speaker denied that enforcement of the accounting and depreciation philosophies of the F.P.C. are aimed at ruining the utilities and disclaimed any obsessing impulse of F.P.C. to invade or preempt the province of the state commissions. All his associates, he said, have tremendous sympathy for local autonomy and community self-government with abhorrence of excessive centralization. Extension of jurisdiction over intrastate rates will not be sought unless the co-operation with the states (as provided in the federal act) is desired by the states.

A 6-point program for the post-war utility offered by Chairman Olds embraced, (1) competitive rates, (2) abandonment of the idea that long-standing costs are sacrosanct, (3) vigorous and daring concerns should readily absorb straight-line depreciation accumulations, (4) concentrate on the economies of regional pooling, (5) promote the decentralization of industry and further the aim of a balanced rural-urban economy, (6) cooperate with government in conservation of water power and other natural resources. The power industry, he said, should take on a constructive relationship to the government's program of water power development in connection with comprehensive plans for river basins and regional developments.

Seconding Mr. Olds rate suggestion, Chairman Maltbie said that utilities have been slow to appreciate the fact

WOMEN FIX APPLIANCES—Helping to get various small electric appliances back into use are these women employees of the appliance repair division of the Indianapolis Power & Light Co. Most of these appliances represent a vital part of the customers' household equipment. With this assist from the distaff side, the number of small electric appliances repaired during 1943 was more than three times the total in 1942

that reduced rates are a great stimulus to increased consumption. It disturbed him that the railroads of the state are not electrified and that the state could lose industrial standing if the rates were not low enough to hold and attract industries. On the financial and accounting issue, he cited several small companies which are reaping rewards in low-cost refunding and in margins that assure post-war response to community rebuilding movements. He paid tribute to utilities which honestly co-operate with regulation, keep accounts to rigid standards and can ride through disturbances because they are well-financed, well-engineered and efficiently operated.

Regulation vs. Regimentation

Distinction between regulation that merely regulates and that which regiments a planned economy was drawn by John C. Parker. He doubted the common assertion that electric power is an absolutely essential factor in human advancement. That notion rests, he said, on the fact that centrally-produced electricity was so phenomenally successful, in a free economy, against the keenest of competition. "Unless the industry of the country finds itself in a social and economic climate conducive to vigorous growth there will be no increasing use for industrial electrical power." Nor will there be increasing use elsewhere, even with lowered rates, unless the purchasing power is at hand and there is research and development and commercial activity to attract that purchasing spirit. He ended with a plea that regulation stay within bounds and that free people be permitted to determine their own desires and wants.

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Laclede Gets Rehearing in St. Louis Tax Case

The Missouri Supreme Court en banc has granted the Laclede Power & Light Co. of St. Louis a rehearing in the case contesting the legal right of the city of St. Louis to impose the terms of a city ordinance which provides for the levying of a special license tax of 5 percent on the gross receipts of the company.

In a decision handed down on March 6, the Supreme Court upheld the validity of the ordinance. The rehearing will be held at the May term of court.

Union Electric Co. of Missouri, which also serves the city of St. Louis, is not affected by the decision because for years it has been paying the city a franchise tax of 5 percent of its gross receipts for use of city streets.

Urge Post-War Improving of "Human Engineering"

Utility industry must tell the story of its efficient business operation to the people, Edwin Vennard states at E.E.I. commercial committee meeting in Chicago

In opening the general sessions of the E.E.I. commercial committee meeting at the Edgewater Beach Hotel in Chicago last week, Chairman Edwin Vennard, Middle West Service, urged special attention of the industry to what he termed the post-war problem of improving "human engineering." The industry must adopt definite policies in dealing with the public that will build good-will; it must measure public opinion and it must present to the people facts about the benefits they receive from business operation of utilities under government regulation, he said.

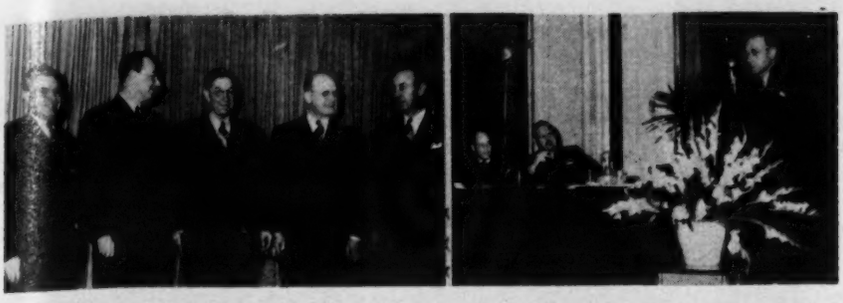
A four-fold rural electrification program for utilities was laid down by Grover C. Neff, Wisconsin Power & Light, which called for: (1) An efficient low-cost light farm line; (2) liberal extension policy; (3) simple understandable rural service rates, and (4) management support of the plan. With two and a half million American farms already electrified, Mr. Neff estimated that another two million exist that can use electric service to advantage. Of these 400,000 are now near existing lines; 1,600,000 will have to be served by new lines. The 400,000 nearby farms should be served as soon as possible from the nearest line. Of the more distant 1,600,000 farms, some will be served by co-ops. Mr. Neff felt that a fair division would be for utilities to serve one million of these. Capital will be required, he said, and the rate of return will be below normal while electrification of the farms is being developed. Present annual farm use of 1,239 kw.-hr. can be tripled by farm market development, and, when it is, the revenue from farm service will be good.

In the industrial field after the war, utilities will be faced with a new game and another set of rules. Emphasis will be on creative selling backed by sound engineering, E. M. Clapp, Georgia Power, said in discussing industrial development and reconversion. If the utilities do a good selling job they can reduce the effects of industrial production cycles. Wholesale revenue will continue to increase, he said, if the industry fosters the migration of plants into its territory that are suited to local conditions; fosters the development of new industries and helps local industry develop new markets for its goods.

G. B. Stainback, Westinghouse Electric & Manufacturing, showed that total energy consumption by all classes of industry in the pre-war period was 82 billion kw.-hr. in 1939; that it had mounted to 152 billion kw.-hr. during the war, and could be expected to continue at levels near 140 billion annually after the war.

H. L. Andrews, General Electric, told the meeting that manufacturers will not be able to bring forward any appliances in early post-war periods that weren't available in 1942. There will be fewer models and higher prices than pre-war, although how much is not known. There are new things in the offing, however, he said. Among these are two-temperature refrigerators, sub-zero or "deep freeze" units and automatic washers. He saw 5,000 kw.-hr.

DISCUSS POST-WAR SELLING — Utility speakers at Industry Post-War Selling Conference were (l. to r.): Julius Daniels, Boston Edison; F. A. Coffin, Wisconsin Electric Power, and M. R. Rodger, Middle West Service. At left: Commercial Committee Chairman Edwin Vennard, Middle West Service, chats with E.E.I. President C. W. Kellogg



SPEAKERS AT CONFERENCES—At the Electric Farm Utilization Conference speakers included (l. to r.): C. H. Leatham, Monongahela West Penn Public Service; Walter Sammis, Commonwealth & Southern; Frank Watts, *Farm Journal*; Arthur Turner, International Harvester, and P. T. Montfort, Texas A. & M. College. Figuring in the tenth anniversary pageant of Better Light—Beter Sight were: Henry Steinmetz, Public Service Electric & Gas (N.J.), at the rostrum; George Whitwell, Philadelphia Electric, (left), and Merrill Skinner, Buffalo, Niagara & Eastern Power (center)

for residential usage in 10 years. Room coolers in 10 percent of homes would add two billion kw.-hr. per year and reverse-cycle refrigeration in one percent of homes, another four to five billion kw.-hr.

In the post-war periods the perishable food industry, according to Clarence Birdseye, General Foods, will be the second or third largest users of electrical energy due to the widespread use of refrigeration that will be required to process, handle and distribute frozen foods.

Ahead in lighting, according to R. C. McFadden, Southern California Edison, are the problems of better street and highway lighting where he found no accord on specifications; re-education of customers in dimout areas who have learned to get along without adequate lighting, and the general task of carrying present high standards of lighting, found in war plants, into the home. Properly handled we can add 300 kw.-hr. annually to our residential load with lighting, Mr. McFadden asserted.

The tenth anniversary of Better Light—Better Sight was celebrated by a pageant which depicted the progress that has been made. At the conclusion, H. P. J. Steinmetz, chairman of the Better Light—Better Sight Bureau, outlined some of its post-war programs which for the home include public school courses, luminaire specifications on which certification can be based, architectural contacts and kitchen lighting. In the commercial and industrial field the tentative plans include certification programs, training programs and education.

Automatic indoor climate will add 250 to 400 kw.-hr. per residence in the heating season and 2,000 kw.-hr. for year-round use, P. B. Zimmerman, president Indoor Climate Institute, said in urging the utilities to sponsor local groups of interested trades.

Co-operation of utilities with dealers was stressed by J. T. Meek, Illinois Federation Retail Associations, who voiced his opposition to financing of mobile equipment through FHA mortgages.

A certification plan for the electrification of new homes through industry co-operation was outlined by M. E. Skinner, Buffalo Niagara & Eastern Power. This plan, which is a modification of the former five-star program, would give a banner for an adequate wiring job with stars for each extra degree of electrification, such as modern kitchen, proper light, air conditioned, electric laundry.

The results of a survey of public opinion to find an acceptable substitute for "kilowatt-hour" was outlined by Edward Vennard, Middle West Service, who is chairman of a committee that is trying to find a simple term customers can understand. The term "electrical unit" is offered and it is suggested that all appliances be rated in "electrical units" or fractions thereof.

At the closing luncheon E.E.I. President C. W. Kellogg stated that if in the post-war we attain the highest civilian production on record there will still be, with some modification, approximately 10,000,000 kw. left to sell after the war.

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Utilities to Resume Oil Purchases

Surplus stocks of fuel oil in storage on the Atlantic seaboard led Petroleum Administrator Harold L. Ickes last week to grant several hundred exceptions to Petroleum Distribution Order 13. Under these exceptions, oil may be purchased for certain otherwise prohibited uses. Eighteen electric utilities were allowed to resume oil purchases for power generation.

The move was similar to that of late October which extented until early January with a salutary effect on utility coal piles, particularly in New England. If all 18 power producers use oil to the fullest extent possible, savings will be at the rate of 1,600,000 tons of coal yearly.

A switch to fuel oil will not entail any physical conversion of plant but will merely entail the shutting down of some coal-fired equipment and the starting of corresponding oil-fired equipment. The relaxation is effective only in PAW District 1, composed of the 17 Atlantic Coast states.

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Krug to Leave OWU for Active Duty

Already sworn in Navy, will report next week—Pays tribute to utility industry for "co-operation"

Director J. A. Krug of the Office of War Utilities was closing the books this week on his career as U. S. power "Czar" preparatory to entering active duty with the Navy as a Lieutenant Commander training for sea duty. Krug was sworn in as a Lieutenant April 10 and promoted one grade to Lieutenant Commander the following day. He will report at Norfolk April 24 to begin training as a damage control officer, with later training at the Philadephia Navy Yard it was announced.

No announcement had been made by WPB as to Krug's successor. It was widely believed throughout the organization that the custom of promoting deputies would be followed to replace Krug with OWU's Deputy Director Edward Falck who has been with the organization since Office of Production Management days.

In a final statement as OWU director, Krug expressed thanks for the "co-operation" shown him by the utility industry in general, asserting:

"I take this opportunity to express my since appreciation for the wholehearted co-operation that the Office of War Utilities and I have had from the entire utility industry and particularly from the power industry where the problems have been most acute, and from the various trade magazines which have helped explain and sell the power program to the utilities and the public. The net result of all this has been that there has always been plenty of power and there always will be for the duration of the war.

"The accomplishments of the industry have not attracted more public attention because they have been done so efficiently and without fanfare. It has been possible to build almost 10,000,000 kw. of new capacity with low ratings

which did not conflict with other urgent, direct war programs."

Krug, who is widely credited in Washington with having compiled one of the outstanding records of any civilian war official, came to OPM as chief of its power division from the Tennessee Valley Authority, where he had been manager of power. Previously, he had been associated with TVA Chairman David E. Lilienthal on the Wisconsin Public Service Commission. The war power organization he built up, which finally became OWU, while relatively unknown even in Washington, is conceded by many to be one of the most efficient among all war agencies.

Krug, who is 36, is married and father of two children.

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Plans $1,000,000 Rural Program

A million-dollar program for the construction of 800 miles of rural electric lines to serve more than 3,400 farm homes is being planned by the Georgia Power Co., President P. S. Arkwright has announced.

It is hoped that 510 miles of the 800 miles of new lines, serving 2,400 farms, can be constructed during 1944. The remaining 290 miles will be built as soon as conditions permit.

Approval of WPB for each of the various projects will be required before it can be undertaken. Copper, aluminum and other critical materials are needed for the construction of electric lines and their use is sharply limited, Mr. Arkwright said. He expressed the hope that the 510 miles of new lines scheduled for construction in 1944 will be regarded as essential to the war effort through the contribution they will make to Georgia's food production.

Georgia Power Co. maintained an active program of rural line construction up to 1941, when wartime conditions forced this activity to be discontinued. At present, the utility serves 63,000 consumers on farms and in rural communities from 4,500 miles of rural electric lines.

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Extends War Insurance

War damage insurance in force March 31 will automatically be extended for twelve months from its scheduled expiration date, Commerce Secretary Jesse Jones has announced. The extension will be made without charge and will require no action by the insured or policy holder to extend the existing contract. New and additional coverage may be had at existing rates.

Reconversion Problems Discussed by Engineers

Utility and manufacturer representatives plan future engineering at annual engineering conference of the Missouri Valley Electric Association in Kansas City—Meeting draws record attendance

Common concern over the system engineering problems of reconversion last week drew a record attendance of 450 utility and manufacturers' engineers to Kansas City for the sixteenth annual engineering conference of the Missouri Valley Electric Association. In the two days of parallel conference sessions, views on present and future engineering procedures were exchanged on overhead, underground, meter, prime-mover, electrical apparatus, accident prevention and power system problems.

At the opening general session, H. H. Kuhn, president of the association and vice-president of Kansas City Power & Light Co. urged that "frills" be eliminated from utility plant. Cost and fixed charges on present and future extensions must be reduced, Mr. Kuhn said, to permit utilities to serve customers at present and lower rates. A widening of the allowable band of voltage regulation may be one way of achieving this, he suggested.

During reconversion, utility sales effort should be on developing existing types of load, J. F. Gaskill, Philadelphia Electric Co. suggested, since there will be no great amount of new load, in his opinion. Increments of load, he said, will be small and must be sold fast to hold system load steady. Mr. Gaskill felt that a large increase in residential load plus a return of commercial load to near pre-war levels will make up for the loss of industrial war load. The expected sharp rise in residential load points, he asserted, to a need for more residential feeder capacity but commercial feeder capacity will not be an immediate post-war problem, he felt.

S. J. Rosch, Anaconda Wire & Cable Co., traced the development of new insulating materials which, he said, have grown out of wartime advances in the use of synthetics. Industrial research in the use of coal, oil and gas in their various forms, will, he said, revolutionize post war equipment in all branches of industry.

C. A. Haskins, War Production Board, Kansas City, said that increasing stockpiles now make it possible to secure materials for almost any essential project. Meters and transformers, however, are scarce items, he declared. Production of new meters since the first of the year has been unsatisfactory, he stated, because manufacturers have been preoccupied with production of more essential radio and radar equipment for war. Mr. Haskins predicted that Order U-1 will be revised soon to elim-

AT ENGINEERING CONFERENCE—Caught chatting while attending the Missouri Valley Electric Association meeting were (l. to r.): E. F. Miller, Iowa-Illinois Gas & Electric; H. A. Howery, Kansas City Power & Light; E. J. Drewelow, Empire District Electric and John Thornberry, Kansas City Canteen, banquet speaker

UTILITY GROUP—Among those who attended the engineering conference in Kansas City last week were (l. to r.): B. V. Garner, St. Joseph Railway, Light, Heat & Power John A. Wallis (standing), Oklahoma Gas & Electric; C. M. Hirst, Missouri Power & Light; L. M. Snyder (standing), Western Light & Telephone and H. J. Skillingstad, Sioux City Gas & Electric

inate regulations pertaining to redistribution of surplus inventories—which have now been drastically reduced. Excess stocks of meters and transformers, he indicated, will continue to be exchanged under U-1 as rewritten.

Gas Turbine Experimental

The gas turbine will not revolutionize the generation of power for the present at least, C. C. Jordan, Allis-Chalmers Manufacturing Co. told the prime-movers group. Metals are not yet obtainable to stand the operating temperatures, he said. Where temperatures in existing installations have been low enough to permit available metals to be used, however, performance has been "marvelous," Mr. Jordan reported. Two classifications of gas turbine unit are suitable for power generation, according to Mr. Jordan: A high efficiency base load unit operating at 1200 deg. with 30 percent efficiency using regeneration, reheat and intercoolers; and a unit of lower efficiency for short time peaking service operating at efficiencies of 20 percent. Gas turbine development could be advanced if a high-temperature unit for such "peaking knocking" service could be installed experimentally on a utility system. Until such a unit has been in operation for two years, Mr. Jordan said, the gas turbine must be considered an experimental development.

In the underground session, T. G. Hieronymus, Kansas City Power & Light Co. presented data on the seasonal variation of earth temperature at various depths. He showed that the time lag between air and earth temperature is approximately the same for both heating and cooling and at different depths will vary with the kind of soil, locations and the range of air temperature.

Presenting survey findings on the cost and failures of socket vs. "A" type meters, C. M. Hirst, Missouri Power & Light Co. concluded that "the good qualities of the type "S" meter outweigh the bad qualities and it is a considerable improvement over the type "A" meter." In the future, however, both types will continue to be used as there is still a demand for the type "A" in the polyphase and primary categories with the type "S" leading in the residential and rural sections.

Meter Obsolescence

Stanley Green, Duncan Electric Mfg. Co., saw as the most powerful obsoleting factor in meter development to date, the surge resistant qualities of modern meters with improved high coercive damping unit. Temperature compensation and installation of many meters out-of-doors is another powerful factor in speeding utility meter obsoleting programs, he stated. "The drive for improvement cannot be resisted, Mr. Green pointed out. We are being pushed forward to the point where it is more economical to retire old apparatus than it is to keep it on the line."

John Drabelle, Iowa Electric Light & Power Co., in discussing bio-chemical products in their relationship to condenser tube corrosion suggested that tin, the higher copper content, and arsenic antimony or phosphorous in admiralty metal apparently act as inhibitors of bactericidal or algicidal attack by waters containing industrial waste and sewage.

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Freeman Discusses Heavy Power Needs

Electric power for war production in the Chicago area is leveling off and output of the Commonwealth Edison group of companies has almost reached a plateau upon which it will probably remain for many months to come, C. Y. Freeman, chairman of Commonwealth Edison Co. said last week in his annual address to stockholders.

While noting that the problem of determining electric service needs for war production is evidently past, Mr. Freeman pointed out that the company still faces the task of providing for continuing heavy demand. He gave the net effective capacity of the four-company group as slightly more than 2,250,000 kw. With this generating capacity Mr. Freeman told the stockholders, the company must expect to carry on at least until the end of the European phase of the war.

It was pointed out that orders for two generating units, one of 150,000 kw. for Fisk station and another for 50,000 kw. for Dixon station of Illinois Northern Utilities had been postponed or canceled by WPB.

"This additional generating capacity, if it were available and in service today, would constitute a substantial and useful reinforcement to our total system capacity. We are still urging the restoration of the Dixon project, and it may be with some success", Mr. Freeman said.

A record peak demand occurred on the Chicago system January 7, 1944 between 8:30 and 9:00 A.M. and amounted to 1,956,000 kw. or about 156,000 kw. more than the peak demand of the previous winter. At the time all but 298,000 kw. of the system's electric generating capacity was required to supply this demand.

"Under ordinary peacetime circumstances", Mr. Freeman said, "this might be considered a fairly safe excess of electric generating capacity over the requirements of our customers, but", he pointed out, "we are not operating today under ordinary circumstances." He showed that longer hours' use of existing capacity has obliged the company to schedule removal of turbines and boilers from service during times of heavy load conditions when ordinarily it would have been preferable to leave them in operation.

New Bill Provides for Power Units

Returning to Washington this week from an Easter recess, Congress had before it an Omnibus Flood Control Bill authorizing the appropriation of about $810,000,000 on numerous river basin improvements which included four and possibly eight power projects.

Power projects definitely scheduled for post-war construction under the bill, which makes no appropriations but merely authorizes them, are The Raystown project on the Raystown Branch of the Juniata River, a tributary of the Susquehanna in central Pennsylvania, at which 54,000 kw. will be installed if the bill becomes law; the Allatoona project on the Etowah River in Georgia, scheduled for 33,000 kw. initially; the Narrows project on the Little Missouri River in Arkansas, scheduled for 15,000 kw., and the Whitney Project on Texas, Brazos River, scheduled for 30,000 kw.

Proposed installations which have not yet been definitely included in construction plans are one project with 42,000 kw. on Arkansas' White River; three projects on the Ohio River Basin, one of 60,000 kw., another of 100,000 kw. and a third of 181,200 kw., this on Pennsylvania's Youghiogheny River composed of seven reservoirs with five powerhouses; the Willamette River in Washington and Oregon, with two proposed installations of 90,000 kw. and 117,000 kw., and some proposed installations in the Missouri River basin not otherwise described.

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Tungsten, Molybdenum Use to be Resumed Soon

Consumption of tungsten and molybdenum for incandescent lamps will continue in the immediate future at the present rate, WPB officials told the board's Incandescent and Fluorescent Lamp Industry Advisory Committee last week. Little change in the production of these metals is now anticipated.

Committee members said the plan whereby manufacturers set aside stipulated percentages of switchboard lamp production to fill orders from specific classes of users had operated efficiently to enable them to catch up on back orders.

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WPB Revises L-154

Manufacturers of circuit-breakers, switchgear and power switching and distribution equipment have been advised by WPB that minor changes in Schedule IV of Order L-154 may be made but that no changes involving appreciable extra material may be contemplated. No further tightening of the schedule is to be anticipated, but revisions will be confined to changes advisable because of increased supplies of certain materials, changes lowering the manpower required and those which are necessary to avoid production of inferior products.

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Vote Down City Plant

The municipal ownership referendum in Madison, Wis., under which the city sought to acquire the property of the Madison Gas and Electric Co. was voted down last week by a two to one ratio. The vote was 12,940 against, and 6,955 in favor of the acquisition of the Madison utility. John St. John, president of Madison Gas & Electric said: "This is a decisive victory. It is the first time that a referendum has carried every one of the 20 wards in the city."

Fluorescent Units Curtailed Says WP

Military demands for radio and rada transformers have curtailed the manu facture of transformers and ballasts fo fluorescent lighting fixtures. WPB o ficials warned the industry last week

Meanwhile, the industry has volu tarily curtailed production of those type and sizes of these items not in genera demand by about 60 percent. About 2 types of ballasts and 10 types of tran formers, for hot and cold cathode lamp respectively, are now being manufac tured. Current trend is toward an in crease in production of 15- and 20-wa ballasts and a decrease in 100-wa ballasts.

The Industry Advisory Committe recommended that production of fluore cent fixtures be brought into balanc with production of ballasts and tran formers for them and that manufactur of less essential fixtures be further re stricted.

MEETINGS

Association of Iron and Steel Engineers—Spring conference, Wm. Penn Hotel, Pittsburgh, Pa., May 8. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Pennsylvania Electric Association — Electrical equipment committee, Brunswick Hotel, Lancaster, Pa., May 11-12 (corrected dates). A. N. Shealy, chairman, Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md.

Previously Listed

American Institute of Electrical Engineers—Northeastern district, Hotel Statler, Boston, Mass., April 19-20; national technical meeting, Jefferson Hotel, St. Louis, Mo., June 26-30. H. H. Henline, national secretary, 33 W. 39th St., New York 18, N. Y.

Missouri Association of Public Utilities—Annual meeting, Jefferson Hotel, St. Louis, Mo., April 19-20. Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

National Electrical Wholesalers Association—Second war conference, Stevens Hotel, Chicago, Ill., April 20-22. C. G. Pyle, managing director, 500 Fifth Ave., New York 18, N. Y.

National Electrical Manufacturers Association—Spring meeting, Palmer House, Chicago, Ill., April 24-27. W. J. Donald, managing director, 155 East 44th St., New York 17, N. Y.

Illuminating Engineering Society—Southwestern regional meeting, Hotel Baker, Dallas, Texas, April 25; V. J. Graham, regional vice-president, General Electric Co., 1801 N. Lamar St., Dallas 2, Texas. Great Lakes regional meeting, Cincinnati, Ohio, May 20; G. R. Baumgartner, regional vice-president, General Electric Co., Nela Park, Cleveland 12, Ohio.

Edison Electric Institute — Technical committee meetings, Edgewater Beach Hotel, Chicago, Ill., May 1-4; annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 6-7. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

National Fire Protection Association—Annual meeting, Benjamin Franklin Hotel, Philadelphia, Pa., May 8-11. R. S. Moulton, technical secretary, 60 Batterymarch St., Boston 10, Mass.

Pacific Coast Electrical Association—Annual meeting, northern section, Fairmont Hotel, San Francisco, Calif., May 10; southern section, Ambassador Hotel, Los Angeles, Calif., May Victor W. Hartley, managing director, 601 Fifth St., Los Angeles, Calif.

Southeastern Electric Exchange—Annual conference, Atlanta Biltmore Hotel, Atlanta, Ga May 10-11. John W. Talley, executive secretary 303 Haas-Howell Bldg., Atlanta 3, Ga.

Pennsylvania Electric Association—Systems operation committee, Benjamin Franklin Hotel, Philadelphia, Pa., May 11-12. E. W. Middleton chairman, Pennsylvania Power & Light Co Hazleton, Pa.

Arkansas Utilities Association—Annual convention Marion Hotel, Little Rock, Ark., May 15- R. E. Ritchie, secretary, P.O. Box 551, Little Rock, Ark.

Public Utilities Advertising Association—Annual meeting, Palmer House, Chicago, Ill., June 6-8. Waldo M. Wright, secretary, Amarillo Gas Co., Amarillo, Texas.

National District Heating Association—Annual meeting, William Penn Hotel, Pittsburgh, Pa June 14-15. John F. Collins, Jr., secretary treasurer, 827 N. Euclid Ave., Pittsburgh, Pa

Iowa Utilities Association — Post-war planning conference, Des Moines, Iowa, June 19-20. W. R. Blake, secretary-manager, 606 Fleming Bldg Des Moines, Iowa.

American Society of Agricultural Engineers—Annual meeting, Schroeder Hotel, Milwaukee Wis., June 19-21. Raymond Olney, secretary St. Joseph, Mich.

American Society of Mechanical Engineers—Semi-annual meeting, William Penn Hotel Pittsburgh, Pa., June 19-22. Ernest Hartford executive assistant secretary, 29 W. 39th St New York 18, N. Y.

Canadian Electrical Association—Annual meeting Murray Bay, Que., Canada, June 22-23 B. C. Fairchild, managing director, 804 Transways Bldg., Montreal, Que.

Society for Promotion of Engineering Education—Annual meeting, University of Cincinnati, Cincinnati, Ohio, June 25-28. F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa

American Society for Testing Materials—Annual meeting, Waldorf-Astoria Hotel, New York N. Y., June 26-30. Robert J. Painter, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa

Output Continues Downward Trend

The output curve moved downward the week ended April 8, 1944, according to figures released by the ison Electric Institute. The amount electrical energy distributed by the ctric light and power industry during week came to a total of 4,361,094,000 kw.-hr., as compared to the figure 4,408,703,000 kw.-hr. for the week evious, which ended on April 1. gures for the week represented an crease of 12.3 percent over the 82,467,000 kw.-hr. distributed during corresponding week a year ago. e output for the similar week two ars ago was lower, the total being 20,858,000 kw.-hr.

All of the seven major geographic ions of the country reported increases the week, the Pacific Coast region ntinuing to lead the field with an inidual gain of 30.2 percent. The uthern States region held on to secd place, with an increase of 13.2 perit. The Mid-Atlantic group reported gain of 9.1 percent with the Central dustrial states running a close fourth th an increase of 9.0 percent. The w England percent gain remained unanged, 4.0 percent. West Central oup showed a gain of only 5.4 perit: the preceding week, 8.6 percent.

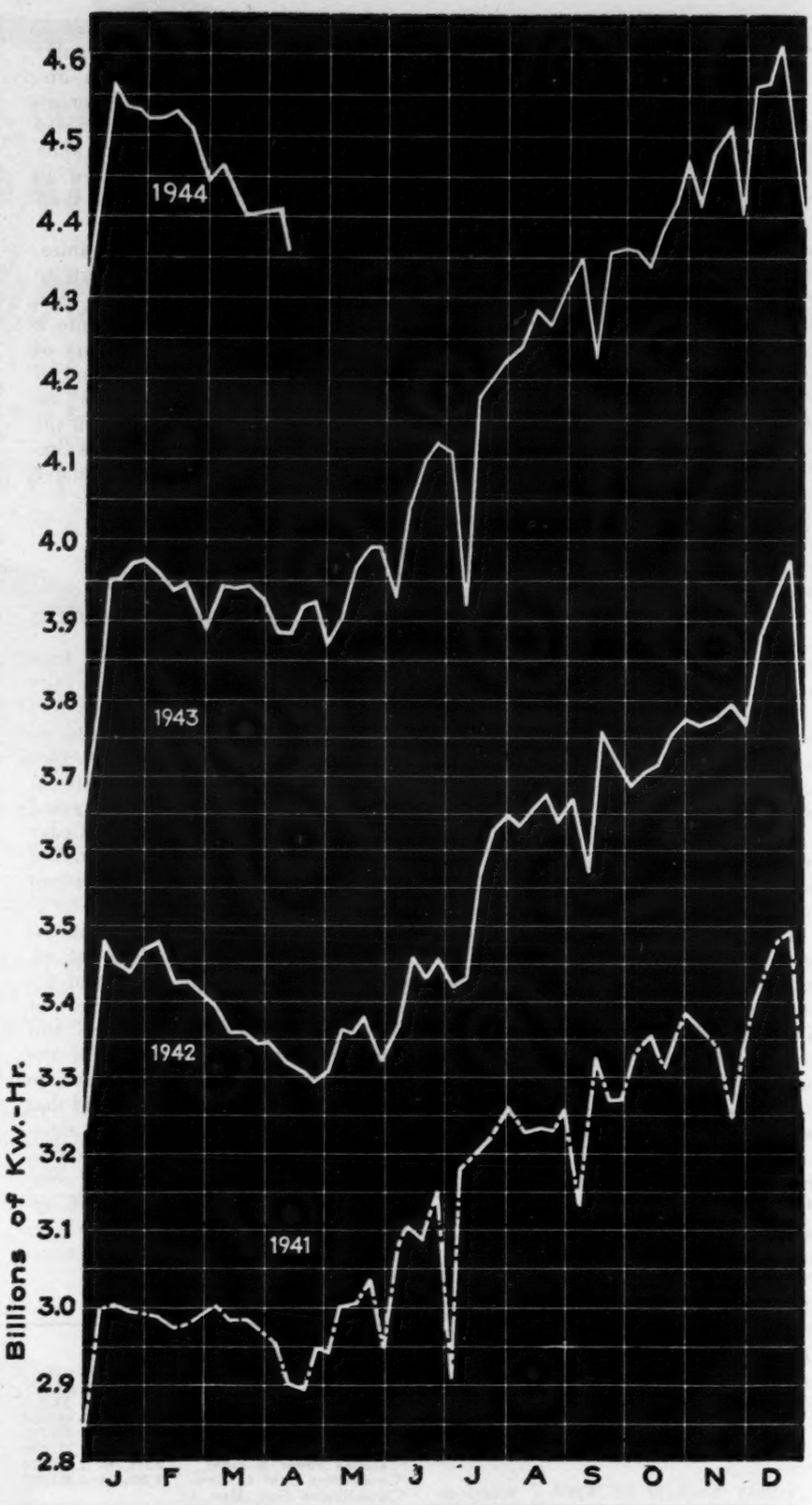
Weekly Output, Millions Kw.-Hr.

1944	1943	1942
. 8 4,361	Apr. 10 3,882	Apr. 11 3,321
. 1 4,409	Apr. 3 3,890	Apr. 4 3,349
. 25 4,409	Mar. 27 3,928	Mar. 28 3,346
. 18 4,400	Mar. 20 3,947	Mar. 21 3,357
. 11 4,426	Mar. 13 3,945	Mar. 14 3,357
. 4 4,465	Mar. 6 3,947	Mar. 7 3,392
. 26 4,444	Feb. 27 3,392	Feb. 28 3,409
. 19 4,511	Feb. 20 3,948	Feb. 21 3,423
. 12 4,532	Feb. 13 3,939	Feb. 14 3,421
. 5 4,523	Feb. 6 3,960	Feb. 7 3,475
. 29 4,523	Jan. 30 3,976	Jan. 31 3,468
. 22 4,531	Jan. 23 3,974	Jan. 24 3,440

Percent Change from Previous Week

	Week Ending		
	Apr. 8	Apr. 1	Mar. 25
w England	+ 4.0	+ 4.0	+ 4.7
d-Atlantic	+ 9.1	+11.1	+11.4
tral Industrial	+ 9.0	+10.9	+ 9.5
st Central	+ 5.4	+ 8.6	+ 6.6
thern States	+13.2	+13.4	+11.1
ky Mountain	+ 6.5	+ 4.5	+ 6.5
ific Coast	+30.2	+29.7	+28.0
otal United States..	+12.3	+13.3	+12.2

bject to revision.



Energy Peak Demands Up 11.7% in January

Federal Power Commission has announced that January 1944 peak demands of the principal electric utility systems of the country aggregated 36,746 kw., an increase of 11.7 percent above the January, 1943, demand. January electric energy requirements amounted to 19,408,860,000 kw. hr., a gain of 12.7 percent over the corresponding month the previous year.

Estimates of December 1944 peak demands made by the Class I electric utility systems in their January reports amounted to 38,587,808 kw. Utility estimates of energy requirements for the year 1944 summarized from the same reports totaled 227,973,404,000 kw.-hr. These estimates for 1944 indicate expected increases over 1943 of about 1,528,000 kw. in December demands and some 12,854,000,000 kw.-hr. in annual energy needs, representing gains of 4.1 percent and 6.0 percent, respectively.

Utility Employees Vote for Strike

Two utility strikes voted, one stoppage ended and a CIO defeat are the outstanding activities on the utility labor front recently reported.

A 30-day notice of intent to strike was approved unanimously by 600 electricians employed by the Detroit Edison on April 5 according to officials of the Electrical Workers Local No. 17 (AFL), Detroit. Notice is to be filed with the War Labor Board section in Detroit according to A. J. Simpson, business manager of the union local.

"The men began negotiations with the Edison company last July 1," Simpson explained. "One offer of an hourly wage increase of five cents by the company was rejected by the board, which, however, was expected to act favorably for us on a wage adjustment this week.

"Edison has informed our men that it will now appeal any directive which may be issued by the WLB here and our members are pretty hot about that.

"I have told the men that they must keep working until all legal moves open to them have been satisfied. They voted accordingly to give due notice of their intent to strike."

Simpson said the electricians now average about $1.31 an hour but are still below the wage schedule provided under the Little Steel formula.

A vote by production and maintenance employees of three New York power companies in favor of a strike proposal has been announced by the National Labor Relations Board, following balloting which resulted in 1,050 votes for a strike, 431 against, with ten void. Meyer S. Ryder, of Buffalo, regional NLRB director, said 1,700 were eligible to vote. Mr. Ryder stated that "this does not necessarily mean that they will go out on strike. . . . This is merely an enabling vote. Companies involved are the Central New York Power Corp., Niagara, Lockport & Ontario Power Co., eastern division, and the New York Power & Light Corp., Oneida District, which together form the central division of the Niagara Hudson Power & Light Corp.

Vote to End Stoppage

Utility workers on April 7 voted to end their 33-hour work stoppage at the Ohio Power Co.'s generating plant at Philo, Ohio, which serves 55 of the state's 88 counties. The workers went out with the 8 o'clock shift on Thursday and began returning to work with the 4 p.m. shift on Friday. Paul Lingo, spokesman for the CIO Utility Workers Union, said that the employees would work pending a settlement of their dispute. Adjudication and adjustment is now proceeding through the regular aggrievance channels. Four men discharged by the company would not return to work while the dispute was being settled. The walkout began when five maintenance workers refused to work because of a change in their work schedules. No load was lost.

The Congress of Industrial Organizations suffered a defeat in its efforts to unite independent unions in the gas, electric power and allied fields into a single utility union when members of Locals 1 and 2 of the Brotherhood of Consolidated Edison Employees recently voted against affiliation with the CIO by 5,174 to 3,651. Voting was limited to employees of Consolidated Edison Co. of New York.

•

Denies Co-Op's Petition for License Rehearing

FPC has denied an application filed by the First Iowa Hydro-Electric Cooperative, with offices in Muscatine and Davenport, Iowa, for rehearing and reconsideration of the commission's order of Jan. 29, 1944, dismissing the application for a federal license for a proposed power project to be located in the Cedar River in Muscatine and Cedar Counties, Iowa, and extending to the Mississippi River north of Muscatine.

The order of denial states that the application for rehearing does not advance any arguments in support of the applicant's position which were not previously advanced in its briefs and considered by the commission in the order of Jan. 29. In that order the application was denied on the ground that the applicant had not presented satisfactory evidence, pursuant to Section 9(b) of the Federal Power Act, of compliance with the requirements of applicable laws of the State of Iowa requiring a permit from the State Executive Council.

Utility Reports

	Net Income 1944	1943
*Alabama Power	$4,359,595	$4,434,384
*Arkansas Power & Light	1,129,158	1,176,778
*Birmingham Electric	1,279,439	1,321,094
*Carolina Power & Light	2,515,195	2,346,534
*Connecticut Light & Power	3,743,804	3,651,017
*Consolidated Gas, Elec. Lt. & Power (Balto.) and sub.	6,286,420	6,200,053
*Consumers Power	7,756,774	7,535,260
*Georgia Power	5,827,540	5,851,766
*Louisiana Power & Light	851,453	1,290,230
*Mississippi Power & Light	605,845	721,715
*New Orleans Pub. Service	1,747,089	2,179,260
*Ohio Edison	3,160,282	3,010,400
*Pennsylvania Power & Light	5,778,028	5,590,600
*Tampa Electric	1,162,023	1,154,760
*Texas Electric Service	1,782,422	1,727,638
*Texas Power & Light	2,751,702	2,042,667
*Washington Water Power and sub.	2,644,479	2,571,288

*Twelve months ended February 29.

A.G. & E. New Budget Approximates '43's

Construction budget of the American Gas & Electric Co. for 1944 will probably be about the same as last year, with more than half the contemplated outlay destined for additions to generating facilities, George N. Tidd, president, stated in the company's annual report just issued covering 1943 operations. Construction expenditures in 1943 were about $20,000,000, including $13,300,000 for new generating facilities, $2,600,000 for transmission lines, $3,500,000 for distribution systems, $500,000 for coal lands and $100,000 for miscellaneous projects.

The war-time construction program of the company was close to completion at the end of 1943, Mr. Tidd said, declaring that the expansion "has always been several steps ahead of the increase in demand and has anticipated the expanding power requirements" of the war program.

The downward trend in sales to small light and power customers continued in 1943, but sales to residential customers showed a small increase due to the addition of about 5,400 new customers and to an increase in average use by residential users, it was revealed in the report.

•

Canadian War Production Has Passed Peak

The peak of war production in Canada has been definitely passed and a progressive shift toward output of civilian goods is gathering momentum, according to the monthly business summary issued by the Bank of Montreal recently. The business summary quotes the latest report of the Wartime Prices and Trade Board in which it was asserted that "the beginning of the end" of shortages is emerging, although somewhat dimly so far, in the picture of civilian supplies.

•

OWU Examines Utility "Critical" Occupations

The Office of War Utilities was seeking from class A and B electric companies this week information relative to the number of employees holding occupations classified as "critical" by the War Manpower Commission and how many of them fall into various age groups subject to military service.

Breakdowns of employees in critical jobs were sought for these age groups: under 26; 26-27; 27-30 and over 30.

The experience of electric utility companies in buying and using

G-E UNIT SUBSTATIONS

is consistently good evidence that our *standardization* policy has an even wider field of usefulness ahead of it.

By systematic analysis of customers' needs—and by co-ordination of our manufacturing facilities—we are meeting *thousands* of ratings and requirements with *relatively few* repetitively built parts.

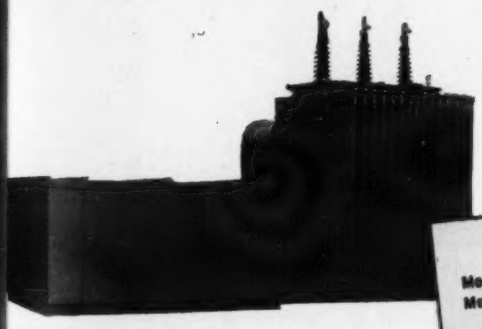
Installation and maintenance have been simplified. There are only two or three factory-assembled sections to install. Maintenance practice can be made uniform, with fewer spares carried in stock.

Specifying and ordering have been reduced to a simple routine that is comparable to changing the figures on a date stamp. Time saved on detailed specification work is available for more thorough system planning.

Installed costs are lower, substantially so when factors such as reliability, safety, and high salvage value are included in the economic balance.

Remember, too, that General Electric's policy of repetitive manufacture *has not* resulted, and *will not* result, in a "freezing" of designs. Our research and design staffs can concentrate on improving the line as a whole rather than continually working out detail modifications in design to meet the specifications of each new order.

As you plan for new substation installations, let us work with you on this route to lower investment costs. *General Electric Company, Schenectady 5, N. Y.*



Typical G-E master unit substation

THE BUILDER APPLIES
More fundamental design time per model
More production efficiency per hour
A New Field for Co-operation
Repetitive Manufacture
THE BUYER GAINS
More kva capacity per investment dollar
Less maintenance cost per year

Save Money and Buy More War Bonds

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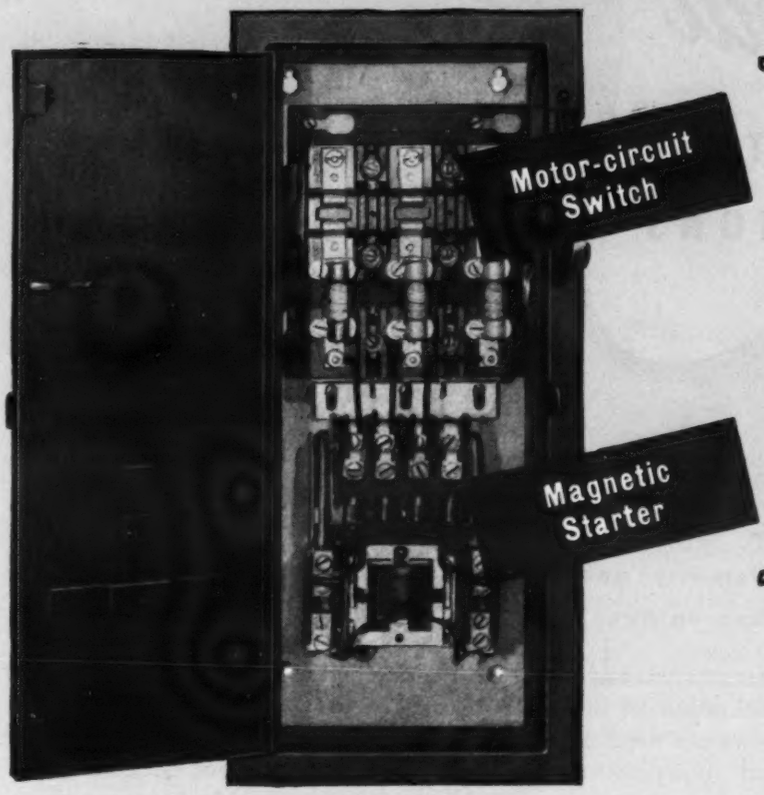
EVERYTHING YOU NEED to



110 to 600 Volts

COMBINATION STARTER

Why two devices? ONE can do the job.

GENERAL PURPOSE	CORROSION-RESISTANT	DUST-TIGHT	FOR HAZARDOUS LOCATIONS	WATER-TIGHT
Type 1 enclosure for indoor applications where atmospheric conditions are normal. Available up to and including NEMA Size 5.	Two forms are available —Type 3 for corrosive atmospheres; Type 8 for hazardous locations. All arcing parts and terminals of Type 8 forms are at least six inches under oil.	Type 5 enclosure for use in steel mills, cement mills, and other locations where the dust content of the atmosphere is so high as to make a dust-tight case desirable.	Type 7 case for Class I, Group D, locations is made of cast, high-strength alloy. Designed to withstand internal explosions.	Type 4 case is suitable for outdoor use, and for damp places indoors, such as dairies, breweries and piers.

control and protect your motor in ONE COMPACT CONTROL UNIT

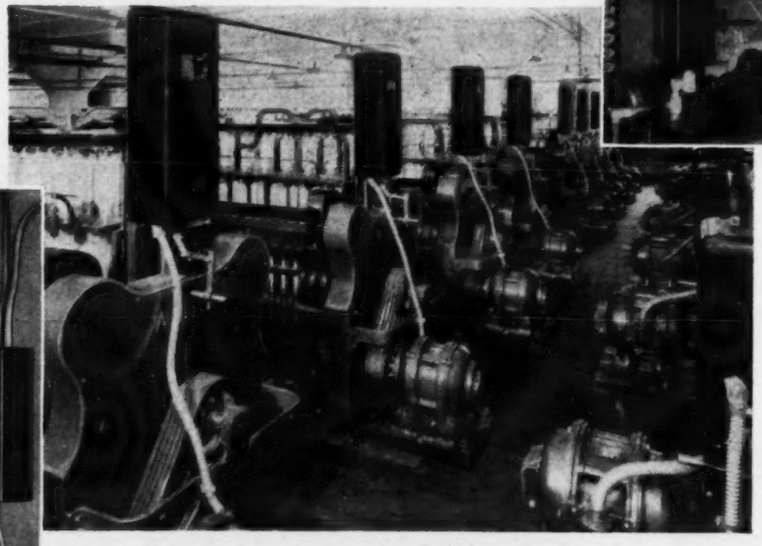
COMPLETE full-voltage control of squirrel-cage motors or the primary control of wound-rotor motors—with extra safety, very low installation cost, good appearance, and other advantages.

Which Type Do You Need?
If you want short-circuit protection, you can select a starter which has a fusible motor-circuit switch or a breaker to provide such protection. Or, if you do not need short-circuit protection, you can choose a starter which is equipped with a nonfusible motor-circuit switch that serves only as a disconnect. Both types are available in a variety of enclosing cases, as shown on the opposite page.

Co-ordinated for Protection
With G-E combination starters, you're sure that the motor-circuit switch or breaker has the proper rating for the magnetic starter with which it is used. The fuses or breakers provide adequate short-circuit protection to the motor, the starter, and subsequent motor-branch-circuit conductors when connected to a power supply for which they are recommended. The co-ordination of thermal overload relays with the fuses or breakers affords complete motor overcurrent protection under any condition of operation.

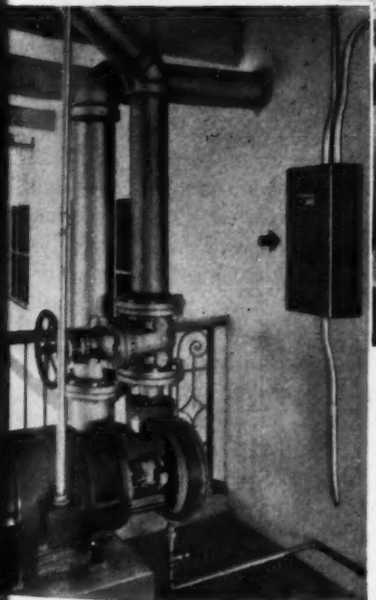
Increased Safety
By placing the motor-circuit switch in the same case with the magnetic starter, the switch can be mechanically interlocked with the cover, so that the cover cannot be opened while there is power on the starter. This is an important advantage because, when a separately mounted switch and starter are used, there is nothing to prevent the operator from opening the case while the starter is "hot."

G-E combination starters can be mounted on or near the machine even in damp locations, such as this pump-room installation.



Combination starters and shipper-rod switches are used to control the operation of each frame operated by this spinning-frame drive.

This combination starter controls a ball-bearing splash-proof motor direct-connected to a centrifugal mash pump in a brewing plant.



WANT MORE DATA? More complete information on G-E combination starters will be found in Bulletin GEA-3715. Ask our nearest office for a copy or write direct to General Electric Company, Schenectady 5, N. Y.

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

GENERAL ELECTRIC

676-130-8920

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Rack Designed For Pole Storage

By JOHN H. McDONNELL.
Division Superintendent,
Jersey Central Power & Light Co.,
Keyport, N. J.

Solution to the storage problem of a quantity of western red cedar poles is the use of racks against which the poles are placed in an inclined position. Poles ranging in length from 40 to 75 ft. are placed at an angle of approximately 45 deg. In that position water drains freely and will not lodge in the poles. It has been found also advisable to store full-treated poles in the same manner.

The racks 24 ft. high were constructed of A-frame supports and a railroad rail securely fastened at the top. Each A-frame is made of 30-ft. poles, has a 10-ft. ground line spread, and is joined at top by two channel irons, each 24 in. long, on which the rail is mounted.

One rack (foreground in illustration) has two A-frames spaced 31 ft. apart and having ⅜-in. guys. At approximately the mid-point of that spacing a single pole is erected vertically to lend support for the rail. A second rack of similar construction (at rear of illustration) is 17 ft. longer and uses a third A-frame.

Some poles will develop "shell rot" when laid on the ground or piled one on top of the other for any length of time without air space between them. In climates where the weather changes rapidly, such as from rain one day to a heavy freeze the next day, poles lying flat and having any sign of a "check" will have this "check" opened by freezing.

To solve the storage problem some companies have tried covering poles with tar-paper and also rolling them over on the platform every 30 days. With a scheme like the one described above the poles can be put in storage and "forgotten" until they are to be used.

POLES racked in storage *Photo by Alex Lisch*

•

Voltage Changes for Emergency Service

By BEN ASKEW
Industrial Power Engineer
Georgia Power Co., Atlanta

Small and inexpensive changes in electrical circuits can often be made which will efficiently and quickly meet urgent war requirements.

Such a situation developed in an idle manufacturing plant in Atlanta which had necessarily been closed at the beginning of the present war. The buildings were modern in every respect with a large floor area, and were much needed in the war effort.

A request for altered electric service for war purposes came in the statement: "We will need within 30 days, 1,500 kva. of capacity to supply 440-v. motors already on machines which are being shipped immediately, these to go into our No. 1 building, and whatever changes are necessary must be made in such a manner that the plant may be reconverted to its peacetime operations upon very short notice."

The entire plant was wired and arranged for 550-v. operation, and such equipment as capacitors, large compressors and lighting service were to continue to operate with this service. In the No. 1 building were one bank of three 667-kva. transformers and another of three 333 kva., in the diagram "A" and "B" respectively.

The three 667-kva. transformers at "A" could be connected for either 11,000 or 22,000 v. on the primary side;

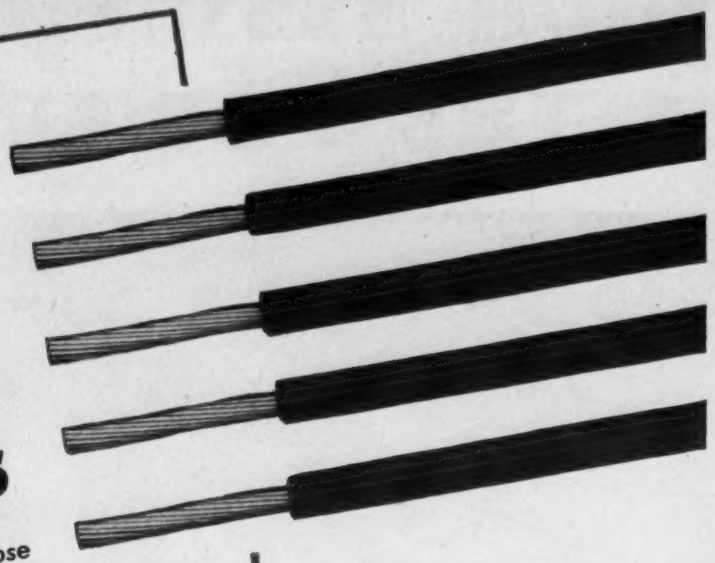
TYPE SNW

FLAMENOL* BUILDING WIRE
(SMALL DIAMETER)

FOR WET LOCATIONS

Now Types SNW and SN Compose
The Flamenol Building Wire Line

*Reg. U. S. Pat. Off.



Flamenol Building Wire can be used for complete wiring installations in any building—Type SN Flamenol wire in dry locations, Type SNW Flamenol wire in wet locations.

Type SNW Flamenol wire has all the desirable features of Type SN Flamenol wire. In addition, its special thermo-plastic insulation has low moisture absorption. It is approved by the Underwriters' as listed in the 1940 N.E.C. in sizes 14 to 4/0 inclusive for use in raceways in wet locations, viz:

1. Underground
2. In concrete slabs or masonry in direct contact with the earth
3. In wet locations
4. Where the condensation and accumulation of moisture within the raceway is likely to occur.

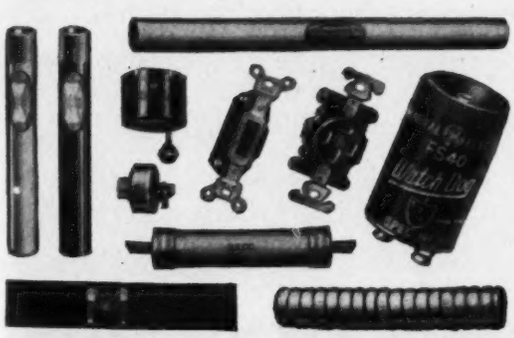
The use of these wires will simplify wiring installations. Entire systems running in either wet or dry locations or both can use Flamenol Building Wires exclusively. The insulations of both Type SNW and Type SN Flamenol wire have long life, are high in dielectric and mechanical strength and are resistant to oils, acids and alkalies.

Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news, every weekday 6:45 P.M. EWT, CBS.

BUY WAR BONDS

G-E CONDUITS AND WIRING DEVICES

General Electric also offers five conduits and a full line of wiring devices including White and Black rigid Conduit, EMT, flexible metal conduit, Fiberduct; and switches, lampholders, outlets, fuses, etc.



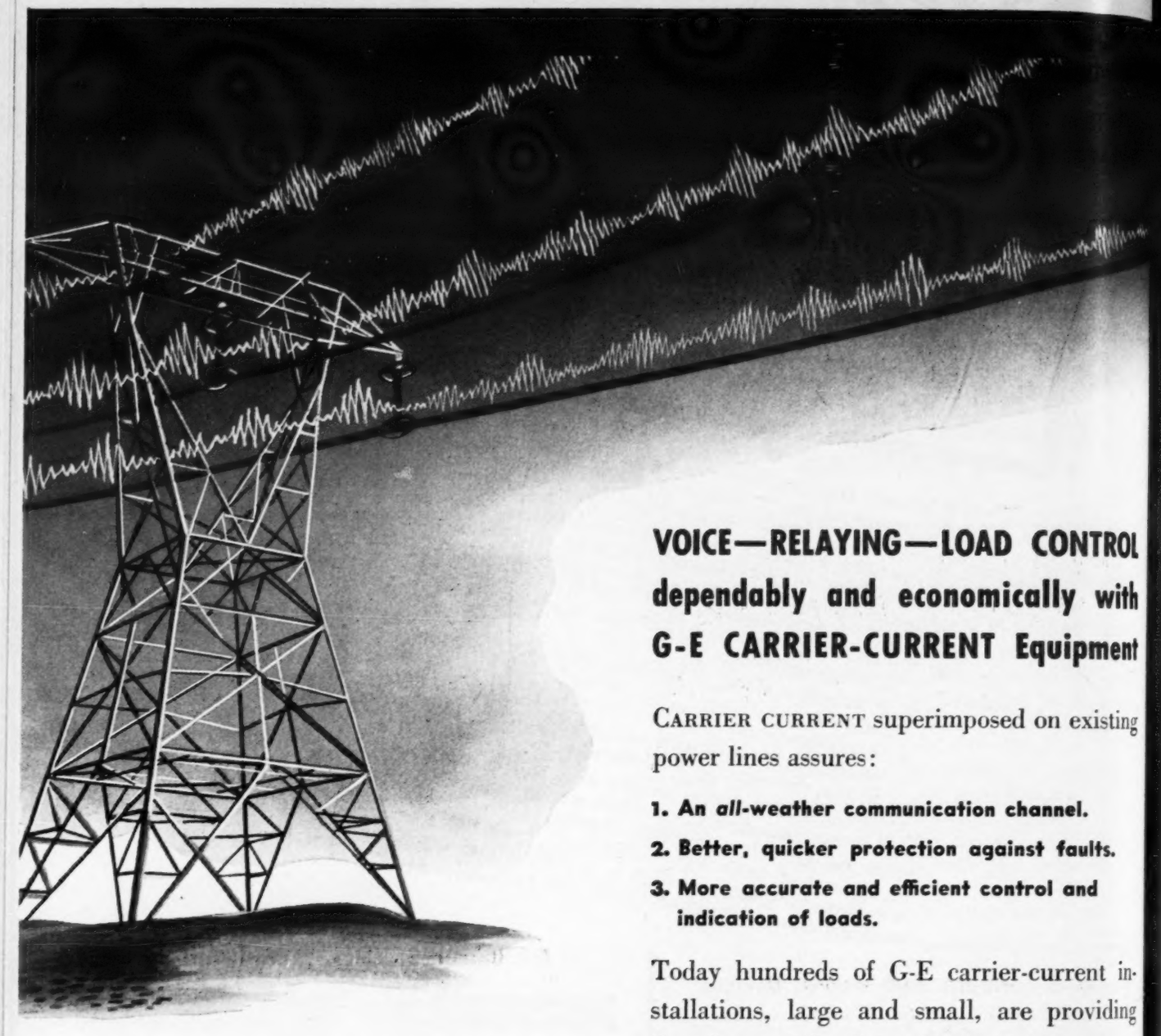
G-E BUILDING WIRES, TYPES R AND RH

G-E Type R, Code grade and Type RH, Heat Resistant grade building wires also are available. These building wires are insulated with synthetic rubber. They are carefully made and will give good service.

FOR FURTHER INFORMATION on Type SNW or Type SN Flamenol Building Wire, or on Code grade or Heat Resistant grade building wires Type R and RH, or on conduits or wiring devices, see the nearest G-E Merchandise Distributor or write to Section CDW-445-9, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

YOUR BEST SIGNAL CIRCUIT IS THE POWER LINE ITSELF



VOICE—RELAYING—LOAD CONTROL dependably and economically with G-E CARRIER-CURRENT Equipment

CARRIER CURRENT superimposed on existing power lines assures:

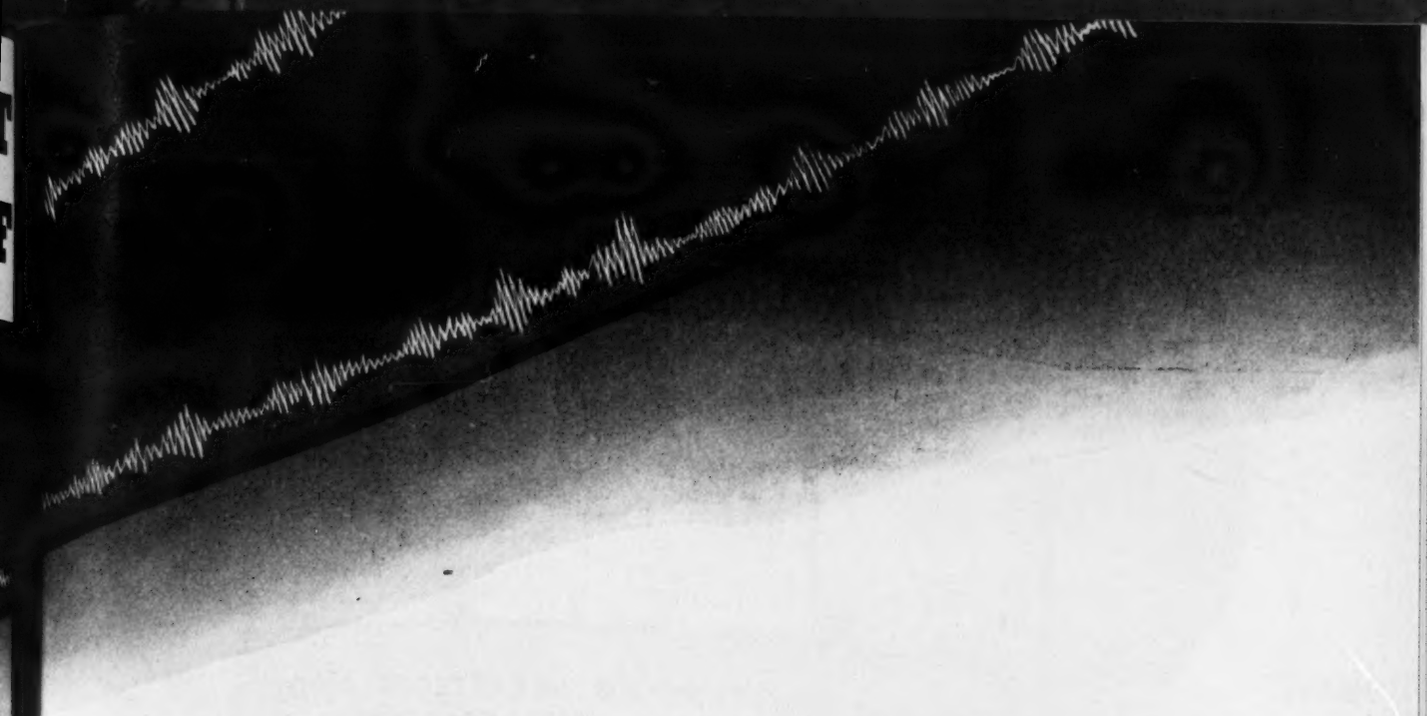
1. **An *all*-weather communication channel.**
2. **Better, quicker protection against faults.**
3. **More accurate and efficient control and indication of loads.**

Today hundreds of G-E carrier-current installations, large and small, are providing the above and other advantages for power companies throughout the nation.

Pilot Relaying. Transferred Tripping. Signaling. Telephony. Telemetering. Super-

GENERAL ELECTRIC

151-87



visory Control. Automatic Load Control. Line Sectionalizing Control. . . . Singly, in pairs, or in multiple combinations, these and other carrier functions may be installed to best fit the needs of your system.

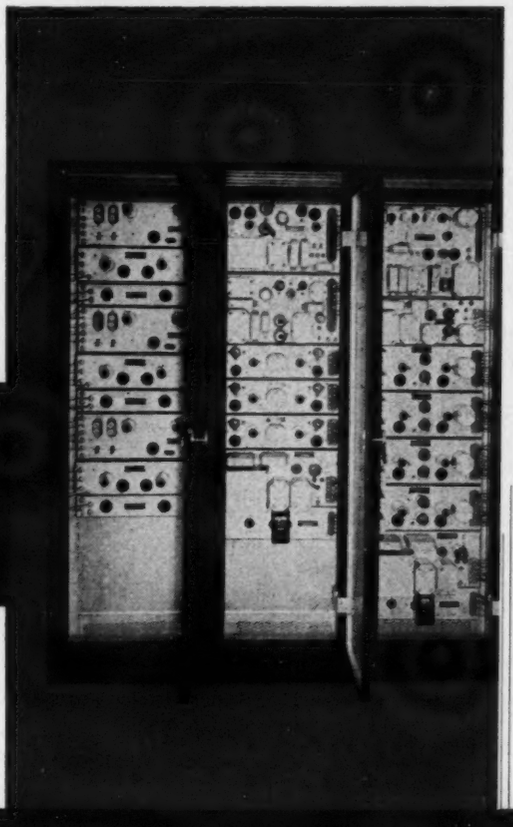
G-E standardized panel-unit assemblies permit step-by-step additions to original installations. Compactly "packaged," carefully built, thoroughly proved, they are capable of performing many functions through few carrier channels—all over one transmission system.

With the highest manufacturing standards, and the know-how of 20 years of research and development, G. E. offers the surest control facilities for better power service to the community.

General Electric engineers are prepared to discuss your needs—TODAY. . . . *General Electric, Schenectady, New York.*

• ***Tune in "The World Today" every evening except Sunday at 6:45 E.W.T. over CBS. On Sunday listen to the G-E "All Girl Orchestra" at 10 P.M. E.W.T. over NBC.***

★ BACK THE ATTACK—BUY WAR BONDS! ★

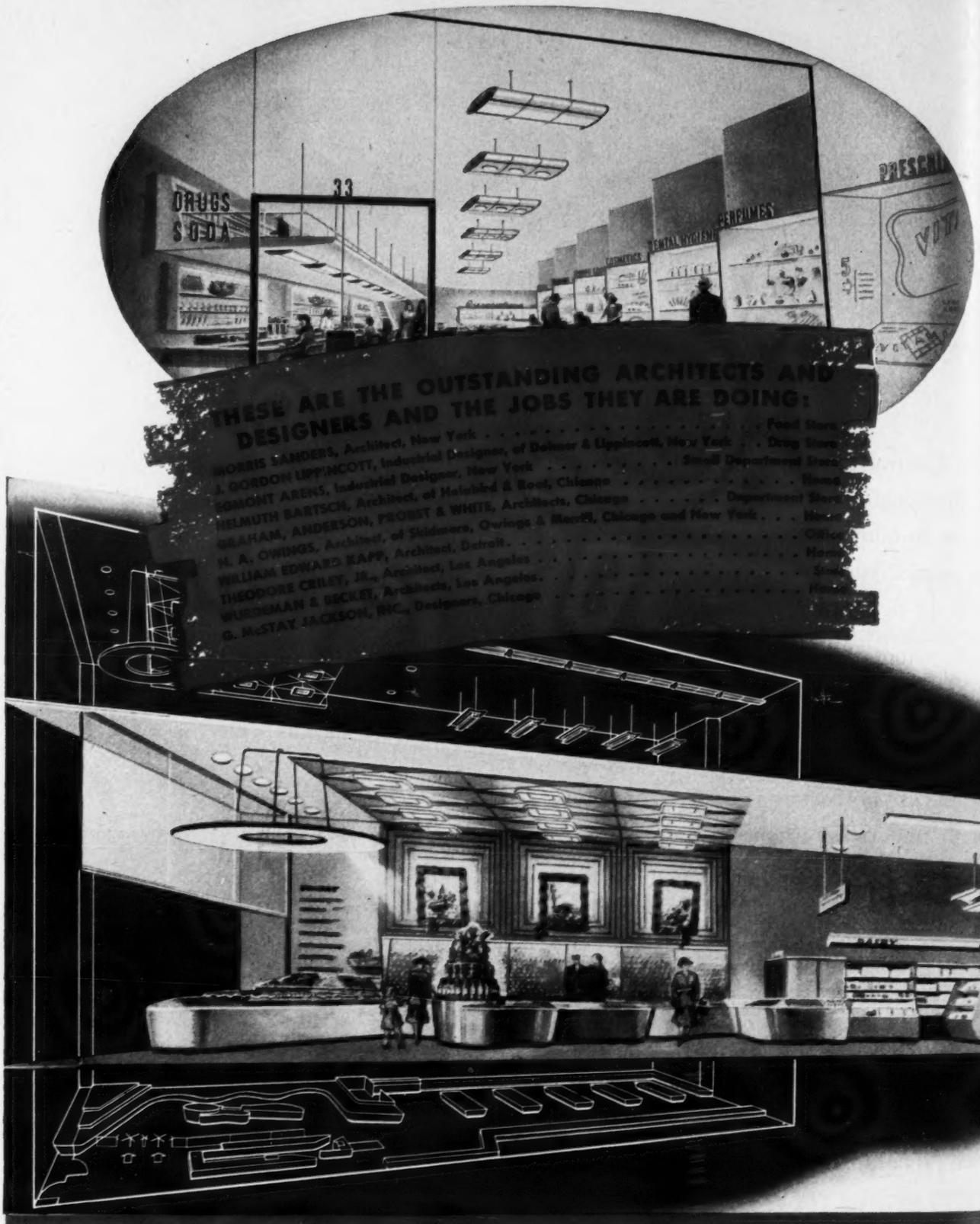


GENERAL ELECTRIC HAS PLANNED AND BUILT MORE CARRIER-CURRENT EQUIPMENT THAN ALL OTHER MANUFACTURERS COMBINED

CARRIER CURRENT

THE NERVE NETWORK OF THE POWER SYSTEM

G-E PAVES THE WAY FOR


DRUGS
SODA
33
PERFUMES
COSMETICS
DENTAL HYGIENE
PRESCRIP
VOT
THESE ARE THE OUTSTANDING ARCHITECTS AND DESIGNERS AND THE JOBS THEY ARE DOING:
MORRIS SANDERS, Architect, New York . . . . . Food Store
J. GORDON LIPPINCOTT, Industrial Designer, of Dohner & Lippincott, New York . . Drug Store
EGMONT ARENS, Industrial Designer, New York . . . . . Small Department Store
HELMUTH BARTSCH, Architect, of Holabird & Root, Chicago . . . . . Home
GRAHAM, ANDERSON, PROBST & WHITE, Architects, Chicago . . . . . Department Store
H. A. OWINGS, Architect, of Skidmore, Owings & Merrill, Chicago and New York . . . Home
WILLIAM EDWARD KAPP, Architect, Detroit . . . . . Office
THEODORE CRILEY, JR., Architect, Los Angeles . . . . . Home
WURDEMAN & BECKET, Architects, Los Angeles . . . . . Store
G. McSTAY JACKSON, INC., Designers, Chicago . . . . . Home

GENERAL ELECTRIC

POSTWAR LIGHTING PROGRESS!

GENERAL ELECTRIC BRINGS TO THE LIGHTING INDUSTRY THE CREATIVE IDEAS OF FAMOUS ARCHITECTS AND DESIGNERS FOR BETTER COMMERCIAL AND RESIDENTIAL LIGHTING

THE postwar store, office and home offer the greatest opportunities for lighting progress in the history of the lighting industry. About 1,500,000 commercial establishments and some 600,000,000 sq. ft. of office space will be ready for better lighting; about 10,000,000 new homes will be needed to bring housing demand into balance with supply in the decade after the war.

To supply these markets with the kind of lighting that sets new standards of comfort and attraction will require development of new and improved lighting techniques. General Electric now offers the lighting industry a comprehensive program to stimulate this development.

G-E Enlists Outstanding Talent

Ten famous architects and designers have been retained by G-E to work out creative ideas for better lighting. Their assignments will cover small and medium-size stores, offices, and low and medium-price homes.

Their plans and suggestions will be made available:

1. To other architects, so that new lighting tools and techniques will become familiar to the entire architectural profession.

2. To fixture manufacturers, so that they may develop lighting units that are acceptable to architects and designers and at the same time efficient and easy to make.

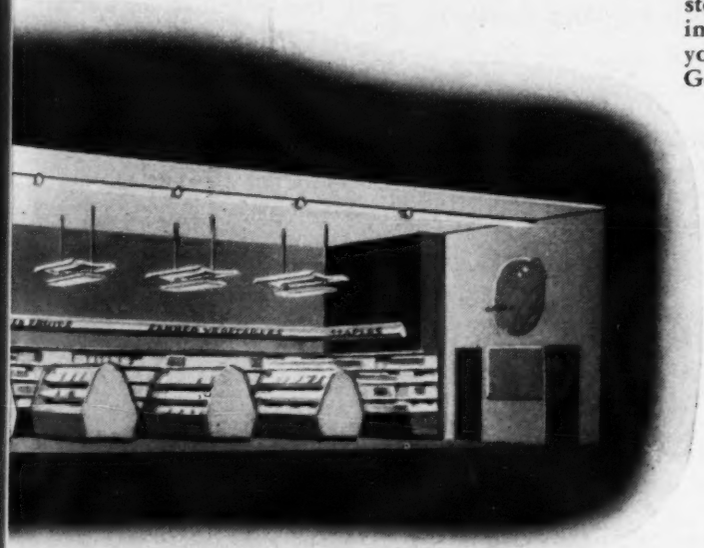
3. To lighting companies and other branches of the lighting industry.

4. To the potential buyers of better lighting, so they may have a wider appreciation of modern lighting practice.

To Promote Lighting Progress

We believe this new G-E program will help the lighting industry give the postwar buyer the benefit of the best planning, the best thinking, and the most effective lighting the industry can provide.

Suggestions for lighting the food store shown at left are described in a new booklet now ready. For your free copy, write Dept. EW-D, General Electric, Nela Park, Cleveland 12, Ohio.



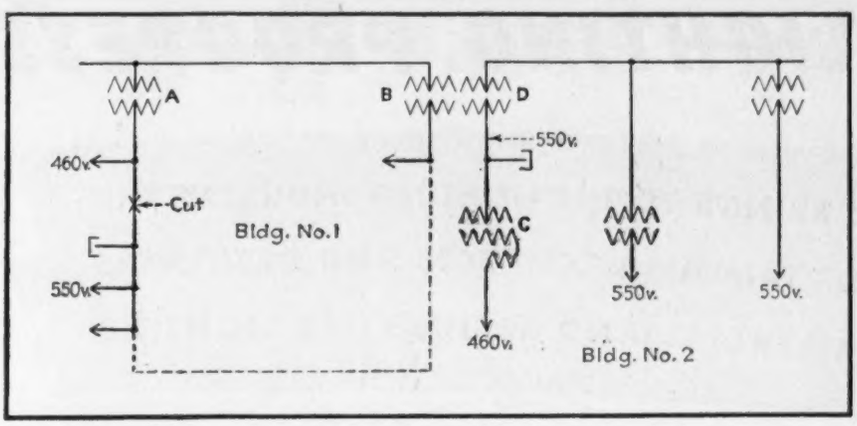
A comprehensive G-E advertising program *will bring the work of these outstanding men to all interested groups. An advertisement featuring the food store, for example, appears in the April issues of Architectural Forum, Architectural Record, New Pencil Points, Chain Store Age (Adm.), Progressive Grocer, National Grocers Bulletin and Super Market Merchandising.*

"TO MAKE LAMPS STAY BRIGHTER LONGER"
The Creed of G-E LAMP RESEARCH

Hear the General Electric radio programs: "The G-E All-Girl Orchestra," Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.

THE BEST INVESTMENT IN THE WORLD IS IN THIS COUNTRY'S FUTURE—BUY WAR BONDS

G-E MAZDA LAMPS



REVISIONS of 550-v. circuits to furnish 460 v. for new machines

they had been operating on the 11,000-v. windings connected in Y to the 19,000-v. lines. These transformers were changed to the 22,000-v. windings and connected delta and supplied from the 19,000-v. lines, which along with an adjustment of the taps gave 460 v. in the amount desired for the new machines from the present connected 575-v. secondary windings.

The transformers are located in the trusses of the building and a short 550-v. tie line was run up and over the roof on horses to the three 333-kva. transformers to obtain the 550-v. service for equipment such as compressors. Buses were simply switched on back of the 575-v. switchboard, leaving the power circuits connected to the 460-v. lines, and shifting the lighting transformers, compressors and capacitors to the new tie line across the roof.

Another request came a short time later for 460-v. service in building No. 2. In this instance the primary windings of all the transformers were arranged for only 19,000 v., delta. Two idle 150-kva. transformers rated 550 to 110 v. were found in the storeroom and these were connected to the 550-v. bus at substation "D," as shown in the diagram at "C."

This connection is the same as used in a number of instances for boosting line voltage where the transformer primaries are connected between phases and the secondaries in series with the lines, except in this instance the 110-v. secondary windings were connected "bucking." Thus these lighting transformers acted as fixed-ratio voltage regulators, bucking the voltage from 575 to 460 v. at the substation.

A point to bear in mind when using these connections is that the bucking transformers will act as open-circuited current transformers if one or more leads of the primary become disconnected; consequently, no fuses or disconnects were placed in these primary connections. It will be noticed also that the 550-v. capacitors are connected so as to continue operation at their rated voltage giving their full kva. capacity.

In all of these connections, careful calculations were made to be sure that transformer windings and feeders were not overloaded when operated at other than rated voltages.

All the requests of the customer were met sooner than needed in each case, and when the time comes to reconvert it will require only one week end to change to full 550-v. operation.

•

Frequency Difference, Supervisory Control

By W. A. DERR
Switchgear Engineer, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

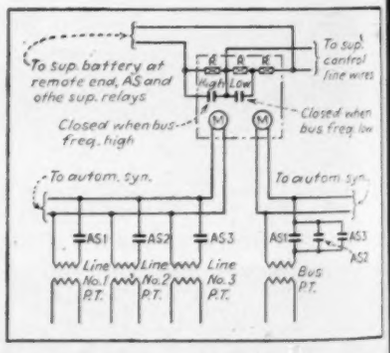
A scheme has been developed in connection with Visicode supervisory control equipment which makes it possible to place an automatic synchronizer into service on a breaker, and then simultaneously to receive an indication showing which of two systems to be tied together has the higher frequency. This indication makes it possible for the supervisory operator to take the necessary steps to raise or lower one of the frequencies involved, so as to enable the automatic synchronizer to close the breaker. Depending on the local conditions involved, changing the frequency of one of the systems means the operation of the governor controlling the system frequency.

Frequency indication is made possible by what is known as a frequency difference transmitter. This transmitter consists of two 600-rpm. synchronous motors, mounted so that they drive the main gears of a differential in opposite directions. A moving contact arm is fastened directly to the output shaft of the differential. The device also has two stationary contacts with which the moving contact can make contact. No friction clutch or slip device is used, since the motor characteristics are such that the additional load imposed when the contacts are closed will cause one or the other to slip out of step without loss or reversal of torque.

The contacts of the frequency difference transmitter are connected to internally mounted resistors, so as to provide for different voltage outputs, depending on which contacts are closed. The essentials of, and the necessary connections to, the frequency difference transmitter are indicated in the illustration.

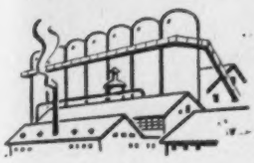
To obtain supervision of line wires when the equipment is at rest, a d.c. potential may be placed on the line wires at the remotely controlled end. This maintains a relay in the energized position at the dispatching office, thus continually supervising the continuity of the control channel. When a frequency difference transmitter is used, this potential for supervising the line wires is supplied from the resistors mounted inside this transmitter which is connected to the supervisory control line wires at all times (normal or at rest).

When the frequency difference transmitter is not in use, no potentials are connected to the motors of the transmitter and neither contact is closed. Under these conditions, a constant percentage of the supervisory control battery voltage is impressed



SCHEMATIC diagram of frequency difference transmitter: M = motor; R = resistor; AS = supervisory interposing relay for automatic synchronizing

MECHANICAL GUARDIANS FOR CHEMICAL PIPE-LINES



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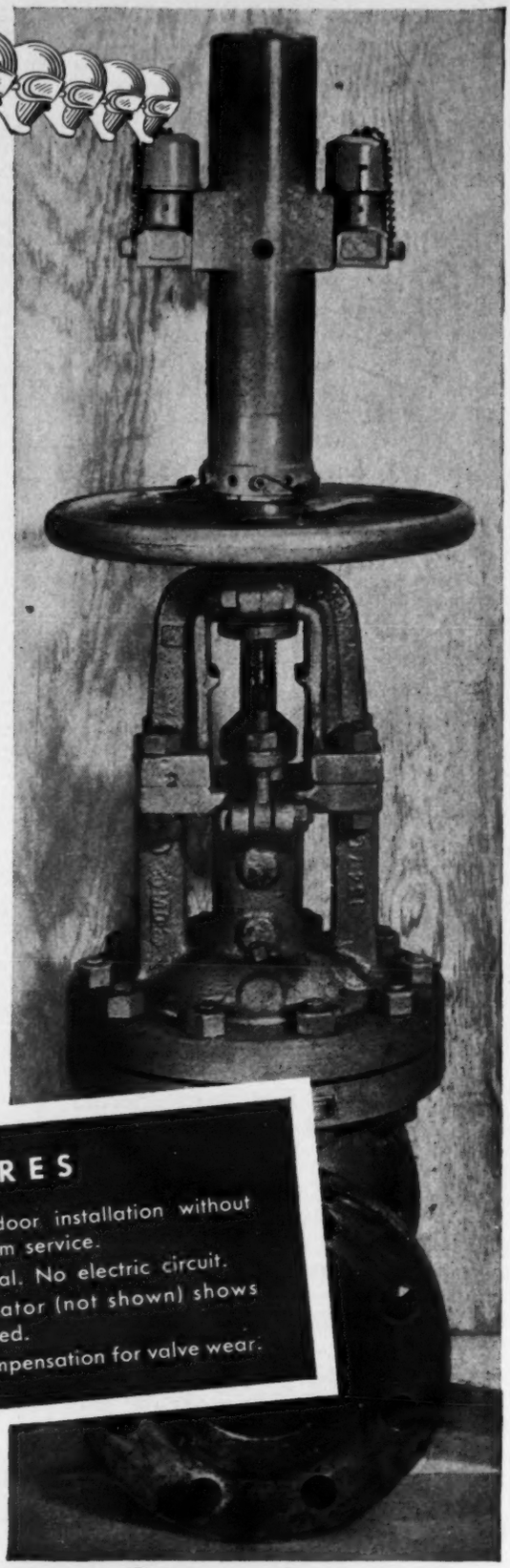

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on the line wires due to the potentiometer arrangement of the resistors in the frequency difference transmitter.

Potential being placed on the line wires results in a small d.c. current flowing over the line wires to keep the relay energized at the dispatching office. This current is also made to pass through a d.c. milliammeter which is calibrated and marked to indicate whether the bus frequency to which the synchronizing is being done at the remote station is high or low. The left hand side of the scale of the receiver is marked "Bus Frequency Low," and the right hand side of the scale is marked "Bus Frequency High."

The amount of current which passes over the line wires from the frequency difference transmitter, when no synchronizing potentials are connected to the transmitter, cause the pointer of the milliammeter at the dispatching office to be in the position between the two halves of the scale. A small rheostat is also connected in this line circuit at the dispatching office to enable the operator to have the pointer coincide with the halfway mark of the scale, despite any change in the remote station supervisory battery voltage or change in line wire resistance.

When no AS relays (indicated in illustration) are energized, the pointer of the frequency-indicating receiver at the dispatching office will be at the dividing mark between the two halves of the scale, and neither of the contacts of the frequency difference transmitter will be closed.

•

Portable Light Plant for Night Line Work

For night line work a portable, self-powered lighting plant has been assembled by Harold E. Chapman, line foreman in Wisconsin Power and Light Co.'s northern division. The miniature plant is used to light up pole tops in remote spots inaccessible to trucks equipped with spot lights.

Chapman's lighting plant consists of an air-cooled Briggs and Stratton washing-machine-type gasoline engine direct-connected to an automobile generator. Both elements are mounted on a channel iron base, complete with charging relay and ammeter. A salvaged storage battery and truck spotlight, mounted on its own frame, completes the plant which is light enough in weight to be carried by two men to the spot where it is needed.

High lines in the area around Birnamwood where Chapman's crew operates are single circuit. Much major work on the lines must be done at night when load is light. With the portable lighting plant, jobs that ordinarily would require several hours to do in darkness now are done speedily, safely and with little interruption, it is reported.

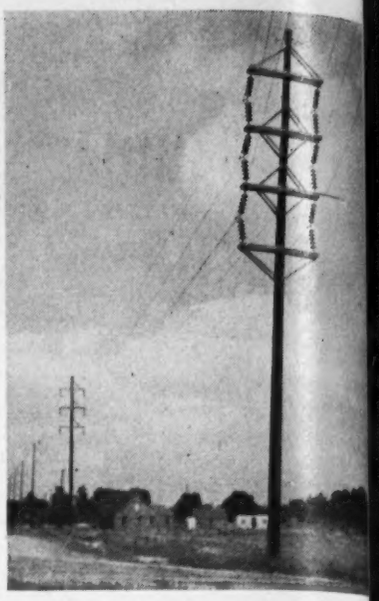
•

Single-Pole Structure Does H-Frame Duty

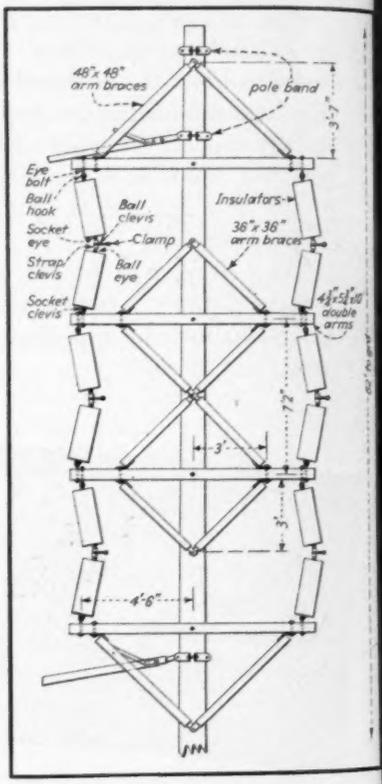
Inability to secure the necessary right-of-way for an H-structure to "hold" a heavy corner in a 66-kv., double-circuit, wood-pole transmission line led Public Service Company of Oklahoma, Tulsa, to adopt the compromise structure shown.

Four such structures were used in making a 60-ft. offset in a section of the line. Maximum estimated side strain on such structures is 475 lb. per conductor. The conductors are No. 3/0 stranded copper, strung in 300-ft. spans on 70-ft. poles. Each structure is guyed at two points, above the top crossarm and below the bottom crossarm. The structure was designed by Hughes Brothers, Seward, Neb.

On tangent structures the six conductors of the double-circuit line are supported from strings of five 10-in. diameter suspension insulators. The line is provided with an overhead ground wire.



SINGLE-POLE angle structure in 66-kv. double-circuit line substitutes for H-frame; angle is 12 deg., span 300 ft., conductor No. 3/0 stranded copper



DETAILS of corner structure; maximum side strain is 475 lb. per conductor

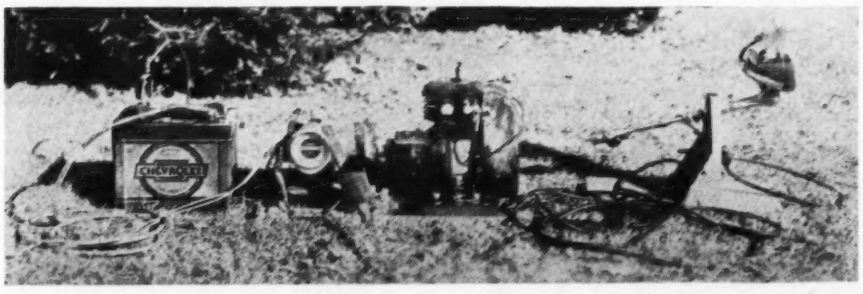


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Chart For Determining the Maximum Length of Time a Given Transformer Overload May be Carried

By H. B. KEATH and W. L. J. F. GODIN† Wagner Electric Corp., St. Louis

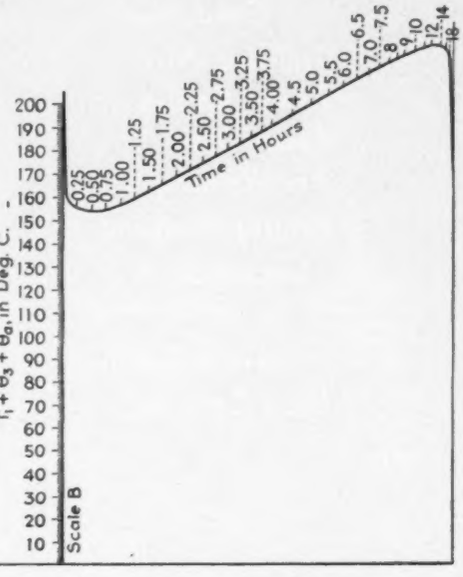
When the following are known:

1. Load previous to overload
2. Ambient temperature
3. Maximum hot spot temperature
4. Maximum oil rise

Given a definite overload and the starting conditions, such as ambient temperature, and load on the transformer, and maximum oil rise, this chart will determine the number of hours the unit can operate without exceeding the prescribed hot-spot temperature tabulated on the chart. The nomogram is directly applicable only to 55 deg. C. rise self-cooled transformers. The chart and Table I are based on time constant = 3.33 hr.

In developing this chart is was assumed that the starting conditions were constant. However, it must be borne in mind that ambient temperature may vary during the overload period, in which case it may become necessary to make a correction for the existing ambient.

If load is to be increased during a period of the day when ambient normally increases, simply add the average estimated ambient increase to the existing ambient to obtain the corrected starting ambient. Strictly speaking this is not quite correct since there is a fairly large time lag between the rise of ambient and the corresponding rise in the oil due to the large thermal capacity of the transformer. However, this correction has been neglected in the chart because it is more conservative not to take it into effect.



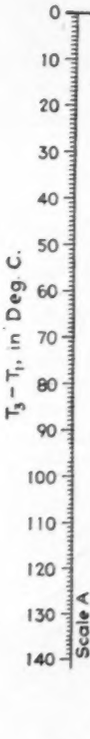


Table I
Maximum Oil Rise

n	θ_2 deg. C.	T_3 m = 2:1		m = 3.5:1	
		55° C. Trans.	40° C. Trans.	55° C. Trans.	40° C. Trans.
0	0	18.7	12.45	13.5	9.0
10	0.50	19.0	12.65	14.3	9.5
20	1.52	19.9	13.28	15.0	10.0
30	2.92	21.3	14.20	16.9	11.3
40	4.62	23.3	15.52	19.3	12.9
50	6.60	25.8	17.20	22.4	14.9
60	8.83	28.8	19.20	25.8	17.2
70	11.3	32.3	21.5	30.0	20.0
80	14.0	36.1	24.1	34.6	23.1
90	16.9	40.4	26.9	39.6	26.4
100	20.0	45.0	30.0	45.0	30.0
110	23.1	50.0	33.3	51.2	34.1
120	26.8	55.3	36.8	56.9	37.9
130	30.4	60.9	40.5	63.7	42.5
140	34.3	66.8	44.5	70.5	47.0
150	38.3	73.1	48.8	77.5	51.6
160	42.4	79.6	53.1	84.6	56.5
170	46.7	86.4	57.5	92.5	61.6
180	51.2	93.4	62.2	100.8	67.0
190	55.9	100.8	67.2	109.0	72.7
200	60.6	108.6	72.2	117.5	78.3
210	65.6	116.2	77.2	127.0	84.5
220	70.8	124.3	82.6	136.2	91.0
230	75.8	132.6	88.2	148.0	98.5
240	81.2	141.1	93.8	156.0	104.0
250	86.6	149.9	100.0	165.0	110.0
260	92.3	158.9	106.0	175.6	117.0
270	98.0	168.1	112.0	186.0	124.0
280	103.9	177.5	118.4	197.0	131.0
290	109.9	187.1	125.0	208.0	138.5
300	116.0	197.0	131.0	219.0	146.0

Table II
Ultimate Allowable Hotspot Temperature *Vs* Time

t, hours	T, Deg. C.
0	.....
0.25	150.4
0.50	143.6
0.75	139.7
1.00	137.0
1.25	135.0
1.50	133.3
1.75	131.9
2.0	130.7
2.5	128.8
3.0	127.2
3.5	125.9
4	124.8
5	122.9
6	121.4
7	120.1
8	119.1
9	118.1
10	117.3
11	116.5
12	115.8
14	114.6
16	113.6
18	112.7
20	111.9
22	111.2
24	110.6

If daily records show that average ambient is stationary or decreasing during the overload period, make no correction to the existing ambient.

In the original paper the authors included a third table, supplementary to Tables I and II of the chart, which permitted determination of the number of hours operation permissible without exceeding prescribed hot spot temperatures for combination self-cooled and forced-air-cooled transformers where (a) the self-cooled rating is the normal rating and (b) the forced-air-cooling rating is the normal rating.

Examples for Use of Chart

Example 1: Transformer operating at 40 percent load. Ambient temperature 10 deg. C. How long can a 160 percent overload be carried? m = 2 to 1

Solution: From Table I, T_3 = 79.6 deg. C, Θ_2 = 42.4 deg. C. T_1 (for 40 percent load) = 23.3 deg. C. Connect point (T_3–T_1) or (79.6 — 23.3 = 56.3) on A scale to point ($T_1 + \Theta_2 + \Theta_a$) or (23.3 + 42.4 + 10 = 75.7) on the B scale. Where the line intersects the time curve read off the time.

Answer: This gives 5.8 hours with 160 percent load, 10 deg. C. ambient, following 40 percent continuous load.

With the same procedure except with an ambient of 30 deg. C. the time is 2.85 hours at 160 percent overload.

Example 2: Transformer same as example 1, except with a ratio of losses m = 3.5 to 1, normally associated with 25 cycle transformers or 60 cycle transformers with a high ratio of losses.

Solution: From Table I, T_3 = 84.6 deg. C., Θ_2 = 42.4 deg. C. T_1 (for 40 percent load) = 19.3 deg. C. Connect point (T_3–T_1) or (84.6 — 19.3 = 65.3) on A scale to point ($T_1 + \Theta_2 + \Theta_a$) or (19.3 + 42.4 + 10 = 71.7) on the B scale. Where this line intersects the time curve, read off the time.

Answer: This gives 5.2 hours.

Designations used in chart and tables

- T_3 = Maximum oil rise
- T_1 = Oil rise at start of overload
- T = Ultimate hot spot temperature corresponding to time of overload
- t = Time of overload
- θ_3 = maximum hot spot rise for continuous operation
- θ_a = ambient temperature
- m = ratio of copper to core loss at nameplate rating
- n = load in percent of nameplate rating

†From bulletin "Normal and Emergency Loading of Power Transformers" presented by the authors at the MVEA Engineering Conference. See also ELECTRICAL WORLD, March 18, 1944, page 116.

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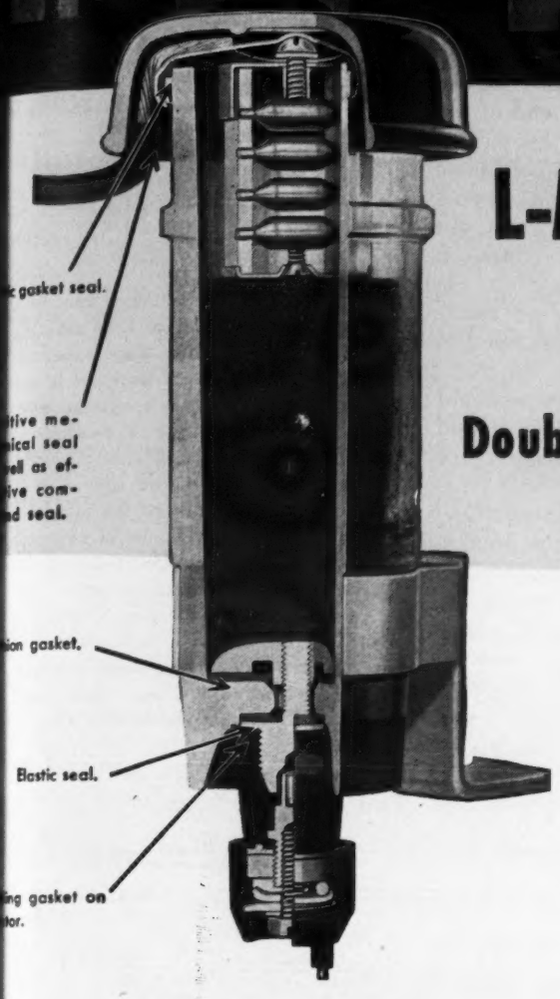

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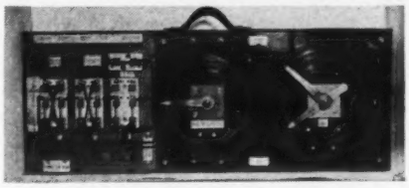
Potentiometer Method to Locate Faults

By H. G. YARRILL
Assistant District Meter Engineer,
Hydro-Electric Power Commission of Ontario

For locating ground faults in buried cables of large size and comparatively short length, a method has been developed involving a potentiometer with a compensating network to eliminate the effect of parasitic currents which may be flowing in the cable sheath.

The test set has been used successfully to locate grounds in cables of 800 to 2,000 ft. in length and from



CABLE-FAULT locating potentiometer

300 to 500 M cir.mil in size. In most cases the fault has been located within one ft. of the actual point of breakdown. It has been found by experiment that the fault resistance may be as high as 10,000 ohms without loss of accuracy of results.

The apparatus consists primarily of a slide-wire potentiometer with the necessary voltage-dividing rheostat and series resistances to adjust the voltage drop over the complete length of the slide wire to a value equal to the voltage drop on the cable or cable loop under test, and the necessary switches and a sensitive galvanometer.

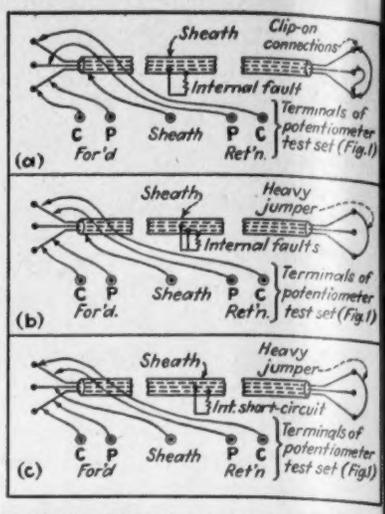
In operation a direct current of from three to five amp. is passed through the cable conductor under test in one direction by closing the current switch (CS) in the "Forward" position (F). The potential drop on the cable conductor is brought down to the potential switch (PS) also in the (F) position, and with the balance switch (BS) in position (B) the potentiometer slide wire is balanced against the cable potential. The sheath will now, due to the fault, be at the same potential as that point of the conductor which is connected by the fault to the sheath, when no current is drawn through the fault.

The transfer of the balance switch to the test position (T) now connects the detecting galvanometer to the moving contact along the potentiometer wire. Moving this contact along the slide wire until zero deflection is obtained on the galvanometer, a point is reached where the potential drop from the "Forward" end of the conductor to the point of fault is equal to that of the portion of the potentiometer traversed from the zero end by the moving arm. The dial reading so obtained gives the percentage distance of the fault from the "Forward" end of the cable.

The current in the cable conductor and the potential drop from it are now reversed by throwing the current and potential switches to the return or (R) position. The previous process is repeated and the result is the percentage distance from the "Return" end of the conductor to the fault.

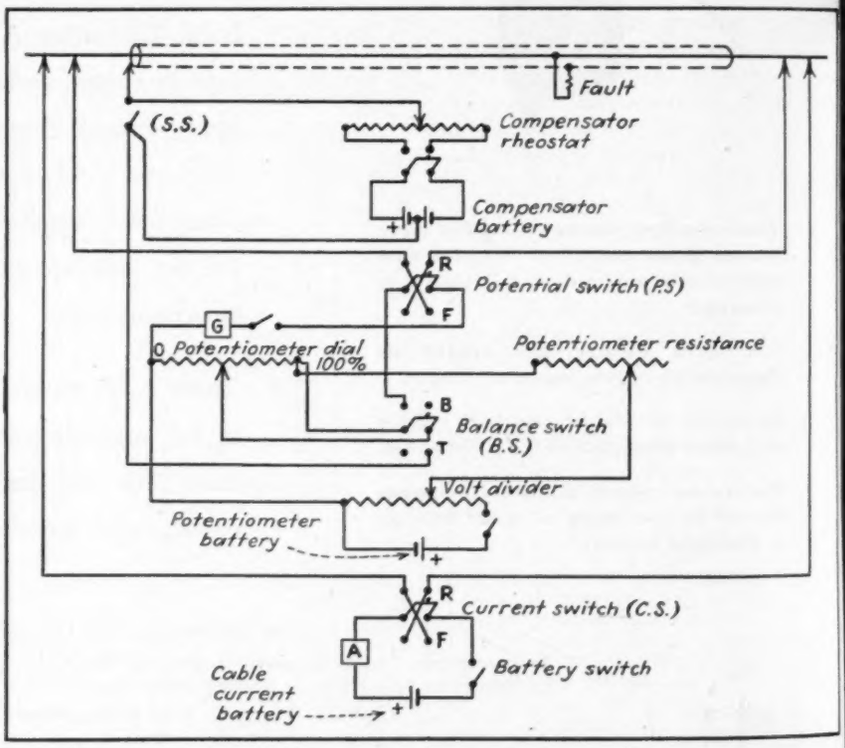
The sum of these two results should be 100 percent of the cable length and provides a check on the accuracy of the readings obtained.

Function of the compensator. Current from some extraneous source, flowing along the sheath, produces a difference of potential between the available point of the sheath, where the test connection is made, and the actual point of contact with the sheath at the fault. This e.m.f. causes a disturbing current to flow through part of the potentiometer slide wire, the galvanometer, the cable conductor and



CONNECTIONS for locating a fault on a three-conductor cable. (a) One conductor faulted to ground. (b) Two conductors faulted to ground. This loop test is also applicable to a single conductor cable where a good conductor is available to complete the loop. (c) A short-circuit between two conductors, no ground fault. Note: In making a loop test the connection completing the loop must be of negligible resistance. If a connection of appreciable resistance must be used, its value must be calculated and expressed in terms of length of a conductor of the same size as the cable under test. This calculated value must be added to the test cable length when computing the final results

through the fault back to the sheath. This current may flow in either direc-



SCHEMATIC DIAGRAM of cable-fault locating potentiometer compensated for parasitic currents flowing in cable sheath

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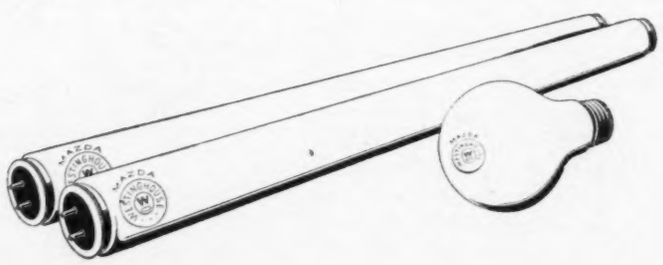
Building today's *super-powerful aircraft engine calls for a high level of See-ability. For each giant 2200 horsepower motor made in this plant demands 80,000 machining operations and 50,000 inspections—130,000 vital seeing jobs where improper lighting could mean a serious, delaying error. See-ability—made possible by today's high-efficiency Westinghouse Mazda Lamps—enables workers to combine hairline accuracy with high speed operation, cuts down eye-strain and fatigue. For efficient, dependable service, recommend bright, long-lasting Westinghouse Mazda Lamps.*

Westinghouse Electric & Manufacturing Company, Bloomfield, New Jersey.

Plants in 25 cities . . . offices everywhere.



Westinghouse

MAZDA LAMPS FOR SEE-ABILITY

Enjoy the Westinghouse radio program with John Charles Thomas, NBC—Sunday—2:30 p.m.—E.W.T.

tion depending on the direction of flow through the sheath. Similarly an e.m.f. set up by electrolytic action in the fault will cause disturbing currents to flow in the same course.

The compensator consists of a center-connected battery system and a voltage-dividing rheostat which will provide a neutralizing current through the potentiometer system to offset the disturbance due to the parasitic current. The direction of this neutralizing current is governed by movement of the rheostat adjustment to the right or left of its center position. Switch (SS) is closed when tests are made for parasitic currents and opened for adjustment of the compensator.

The potentiometer while designed for heavy power cable tests can also be used for smaller cables, if the test current flowing into the cable is reduced in value.

•

Cell Current Controls Chlorine Compressors

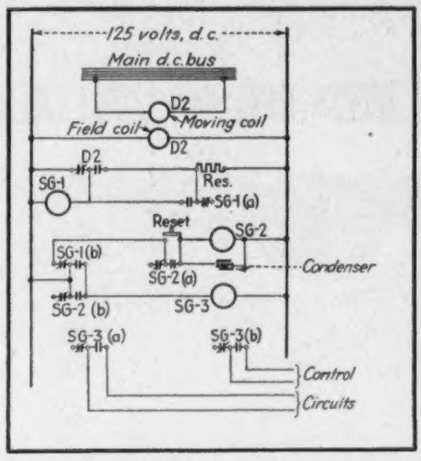
By W. M. ALLCORN

Chief Electrical Engineer, H. K. Ferguson Co., Cleveland, Ohio

Chlorine compressors, drawing chlorine gas from some types of electrolytic chlorine cells, must be stopped immediately on interruption of d.c. power to the cells. In the numerous chlorine plants built by the H. K. Ferguson Co. the compressors are stopped automatically by an arrangement of relays indicated in the accompanying diagram.

The relay equipment consists of a d.c. overcurrent relay such as Westinghouse type D-2 and three auxiliary relays such as Westinghouse type SG. The current relay must be used rather than a potential relay due to the fact that the circuit voltage varies over a range as low as 50 percent of normal. The current also varies over a limited range, but the relay is adjustable over a range of 0 to 200 mv. and can be set to operate at the minimum currents encountered.

D-2 relay is essentially a D'Arsonval type contact-making milliammeter and contains a moving coil mounted in the field produced by a stationary coil. The relay is equipped with a moving contact mounted on the shaft of the moving coil and with stationary front and back contacts. No shunt is required in the main bus since the current (moving) coil of the relay can be connected to a section of the main bus to provide a sufficiently accurate mv. drop for this purpose.



RELAY OPERATIONS in chlorine compressor control; D2 is an overcurrent relay of 0 to 200 mv. shunt drop range, the others are auxiliaries, SG1 with 48-volt coil, SG2 and SG3 with 125-volt coils

SG relays are all two-pole double-throw relays. The main function of relay SG-1 is to supplement the contacts of the D-2, which are incapable of breaking the control circuits. The condenser is provided across the coil of relay SG-2 to provide a time delay of approximately 0.5 second on opening of its contacts.

The reset push-button and relays SG-2 and SG-3 are required to permit the operator to restart the compressors prior to re-energizing the main bus. The equipment will automatically restore itself to the normal condition as soon as the bus is energized. It functions as follows:

1. When the current in the main bus reaches the value for which the D-2 relay is set the moving coil of the relay operates the contacts of D-2.
2. Relay coil SG-1 is then energized through D-2 contacts and in series with resistor. The (a) contacts of relay SG-1 then close to seal this relay in parallel with the D-2 contacts.
3. The (b) contacts of relay SG-1 close to energize relay SG-3, which closes the control circuits for the chlorine compressors.
4. When the current in the main bus drops below the value for which the D-2 relay is set the moving coil of the relay restores the D-2 contacts to the normal or de-energized position.
5. Relay coil SG-1 is then shunted by the D-2 contacts with the resistor thrown across the control circuit until the (a) contacts of relay SG-1 return to normal and open the circuit.
6. The (b) contacts of relay SG-1 also return to normal and open the circuit to relay coil SG-3, which opens the control circuits for the chlorine compressors, thereby stopping the compressors.
7. Pressing the "reset" push-button closes the circuit through the normally closed (b) contact of relay SG-1 to relay coil SG-2. The (a) contacts of relay SG-2 then close to seal the circuit in parallel with the push-button.
8. The (b) contacts of relay SG-2 close the circuit to relay coil SG-3, which in turn closes the control circuits of the chlorine compressors and permits them to be restarted as desired.
9. When the current in the main bus again reaches the value for which the D-2 relay is set the equipment again functions as outlined under 1 and 2 above.
10. The (b) contacts of relay SG-1 then open the circuit to relay coil SG-2 and close the circuit to relay coil SG-3, which was previously closed as noted under 8 above.
11. The (a) contacts of relay SG-2 open the sealing circuit for this relay and the (b) contacts of this relay open the circuit to relay coil SG-3, but the latter circuit remains energized through the parallel (b) contacts of relay SG-1.

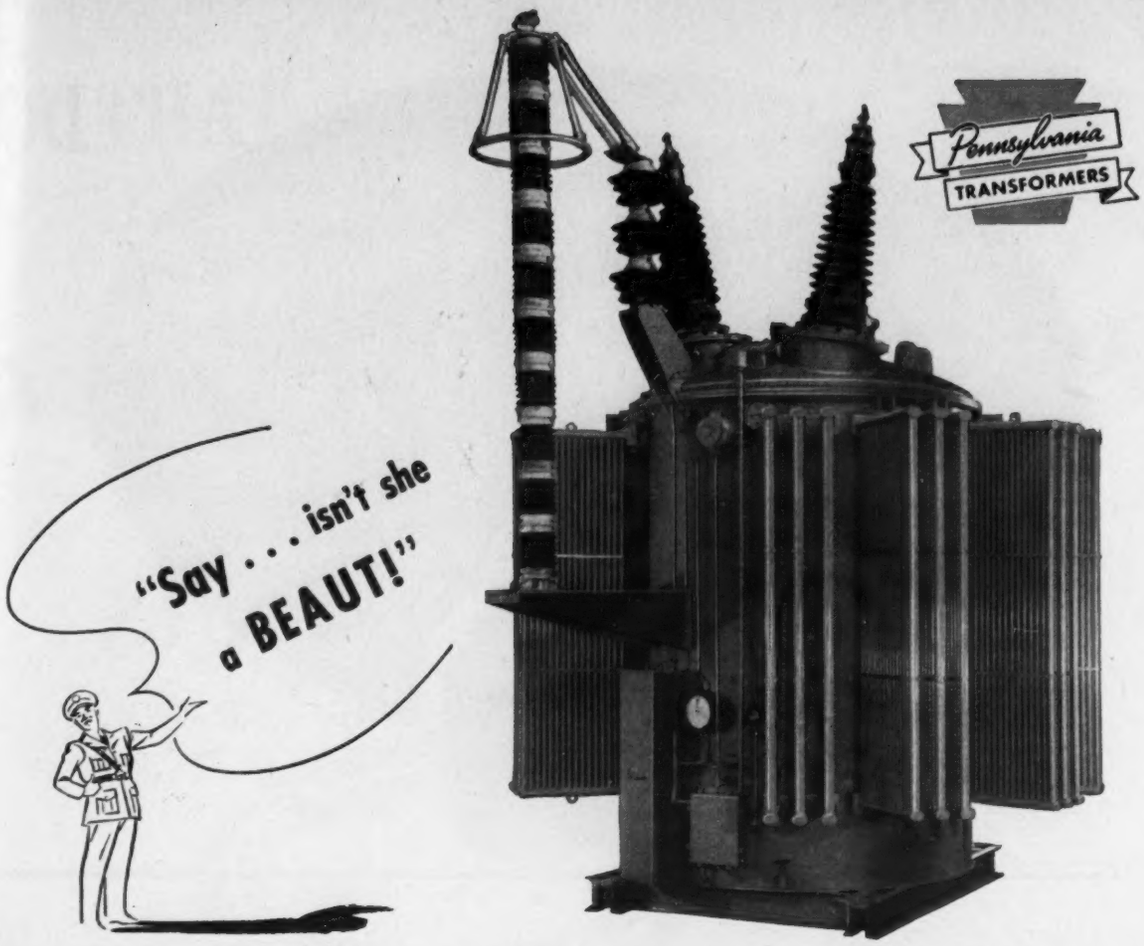
•

Dispenser For Silver Solder

An easy-to-make dispenser simplifies the feeding of ribbon-type solder in silver-alloy brazing work and prevents waste. It was suggested by John Antkowick, a workman at General Electric's Schenectady Works. The dispenser is a flat metal case containing two rollers, one in the circular portion and another near the point. The silver solder is thumb-fed over the second roller and out the point of the dispenser through a slot in the edge of the case.

DISPENSER for silver solder used for resistance-brazing of coil terminals

Previously, the operator would cut a piece of solder about two feet long. As this strip became shorter it would get too hot to handle and the workman would drop it and get another piece. The dispenser can be loaded quickly with sufficient solder for a large number of brazes and permits the operator to keep his hand far enough from the work to avoid being burned.



SHE sure is, Soldier. That Pennsylvania Transformer is a "beaut", and for good reason, too. You see, we think appearances are important — even in transformers. Take, for instance, the one you're looking at — one of the 12,500 KVA's we built for the Bonneville Power Administration. That transformer was designed for performance, but it was also designed for beauty.

You see, Soldier, design can be functional as well as beautiful. The radiators on that transformer are a good example of what we mean. Their job is to cool and distribute the oil. They could very well have been placed on one or two sides of the tank and still comply with all engineering requirements, but our Engineers placed them all around the tank. Why? Because they look better that way and because they distribute and cool the oil with greater uniformity.

Here's another way we look at it, Soldier. Most transformers are located outdoors where they can be seen. The appearance of a transformer has a lot to do with the appearance of a substation. Look at those three banks of 12,500 KVA's — they sure do look good!

Yes, we agree with you Soldier. When you look at a Pennsylvania Transformer, you have good reason to exclaim: "Say, isn't she a beaut!".

Three banks of Pennsylvania Transformers totaling 112,500 KVA—115 KV Class.

DO Y

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THERE are two kinds of fluorescent lighting in common use today—"Hot Cathode," the heater filament type, and "Cold Cathode," the improved shell electrode type.

Zeon Fluorescent Lighting is the outstanding example of the Cold Cathode type . . . it produces a light source that unit for unit will deliver as much light *four to five times longer* than other fluorescent lamps. Burning hours in excess of 10,000 are not uncommon . . . *exceptional* life that means minimum tube replacements, fewer production hold-ups and the lowest possible man-hour replacement cost.

Instant starting is an important feature of Zeon, and in operation, light flow is uninterrupted—a great advantage wi flickering light has been the chief cause of strain. The fewer auxiliaries used, the sim fied fixtures, ease of installation and minim maintenance of Zeon, are additional feat which wise buyers value in fluorescent light

When considering a fluorescent installat look to Zeon Cold Cathode Fluorescent Li ing, a product of Federal Electric Compa Inc., who for over fifteen years have b leaders in the development and use of gas discharge lamps. Capable, experienced F eral lighting engineers are available in m cities to consult with you on your ligh problem. Feel free to call on th

LIGHTING DIVISION

FEDERAL ELECTRIC COMPANY, IN

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Branch Offices: New York, Philadelphia, Louisville, Cincinnati, New Orleans, Dallas, Houston, Indianapolis, Kansas City, Milwaukee, Minneapolis, Duluth; *Subsidiary Company,* Federal Brilliant Company, St. Louis, Mo.; *Associated Company,* Claude Neon Federal Company, Southwest, Wichita, Kansas.

NOW THAT

Fluorescent Lighting

is not alike?

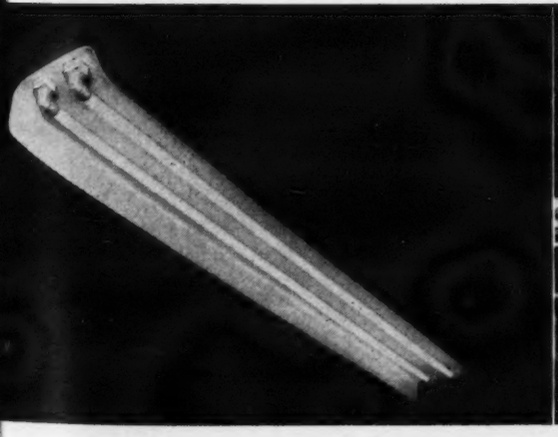
COLD CATHODE

ZEON

FLUORESCENT LIGHTING

Better Light — *Longer Life*

- **LONGER LAMP LIFE**
- **LOWER MAINTENANCE COST**
- **INSTANT STARTING**
- **CONSTANT LIGHT FLOW**
- **LESS HEAT**
- **LESS GLARE**
- **FEWER AUXILIARIES**
- **GREATER FLEXIBILITY**

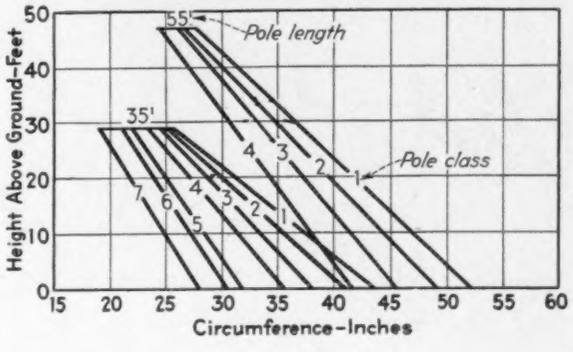


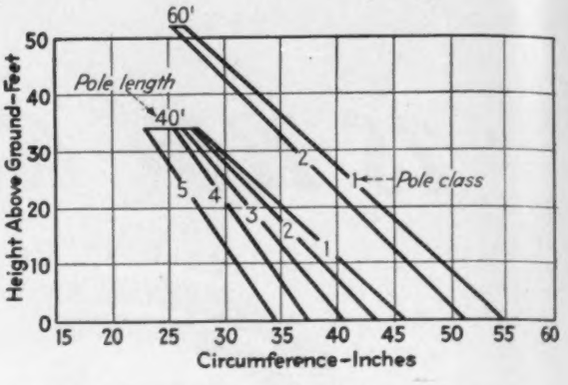
Western Cedar Poles
Dimensions and Resisting Moments

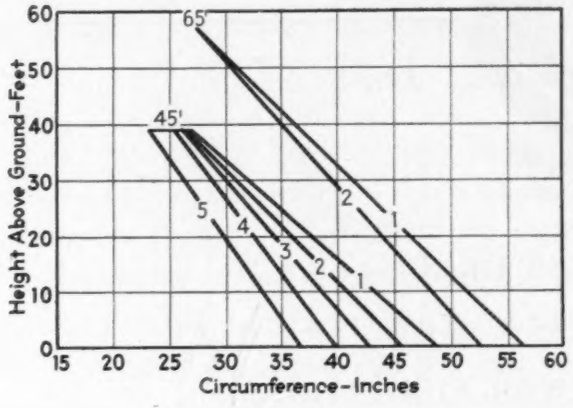
The class, height and type of a given pole being known, the circumference of the pole at any point above the ground line and the resisting moment about that point can be found from this series of charts prepared by the engineering division of the Detroit Edison Co. Used for field estimating purposes these graphical aids have replaced a bulky set of tables which were formerly used for the purpose.

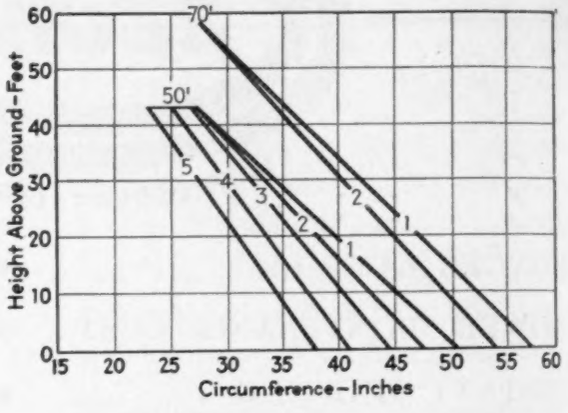
Circumference values from the charts represent average values within the range of tolerance permissible for each pole class. Values are considered sufficiently accurate for field estimating purposes.

POLE DIMENSIONS





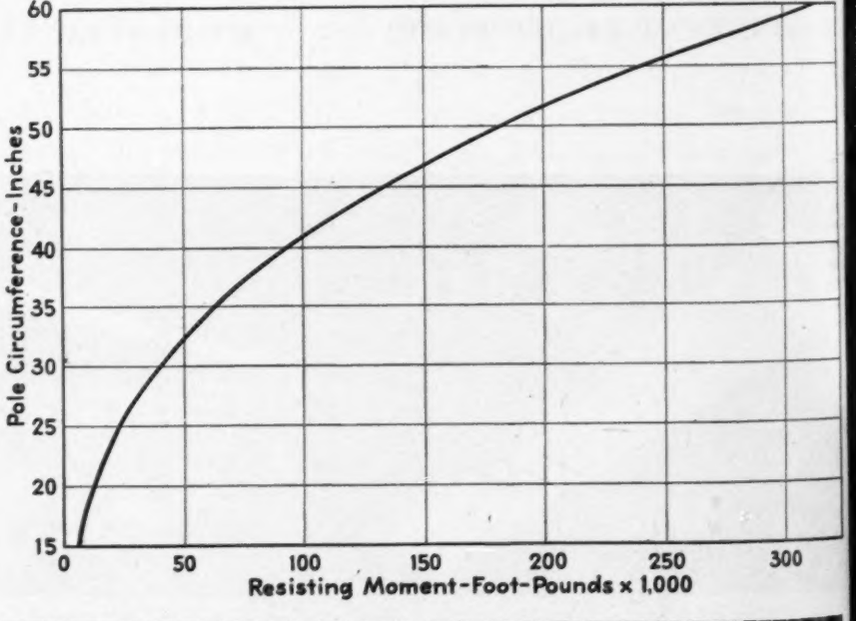




Instructions for Use of the Charts

Determine circumference of a pole at a point above the ground for the class and length of pole from the four top charts.

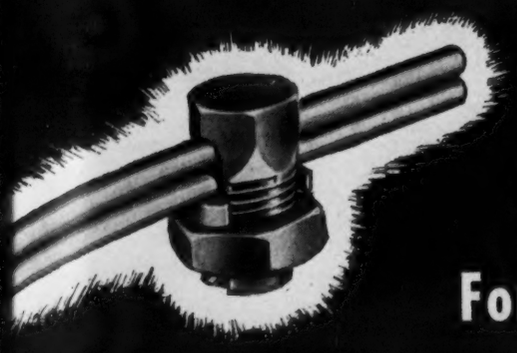
Resisting moment is determined for the respective circumference of the pole from chart at right.

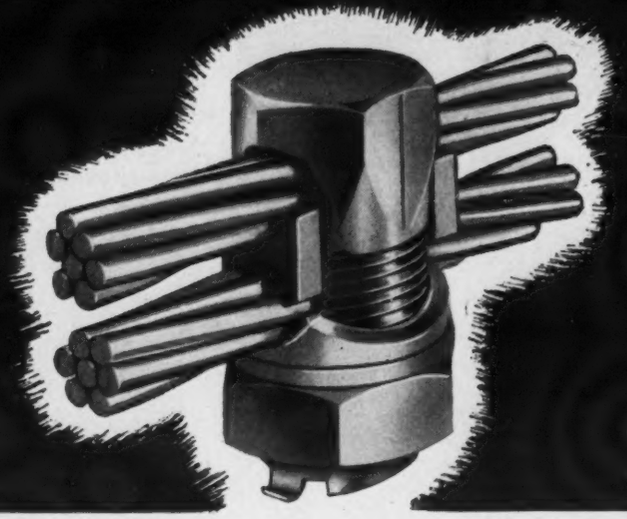


High Strength Factor Makes

KYLE CONNECTORS

Form Better Electrical Connections





YLE Connectors are constructed of the most suitable alloys having high copper content ulting in high conductivity . . . make use en-ely of machine cut threads on body and nut . . . completely refinished overall. This results in connector of the highest strength with result-*higher permissible torque.*

le Connectors produce the highest contact ssure between wires for any given tightening d on the wrench. *Higher pressure,* thus de possible, results in a *better electrical nnection.*

le connectors can be used again and again be-use the higher strength of materials and ma-ne threads keeps the connectors from stretch-out of shape.

Type of Kyle Connectors on which we are able to make immediate deliveries include:

Standard Split-Bolt Connectors for copper to copper connections. Sizes: From No. 8 solid wire to 1000 MCM. Stranded cable.

Standard Cadmium Plated Connectors for steel or aluminum connections. Sizes: From No. 8 solid wire to 1000 MCM. Stranded cable.

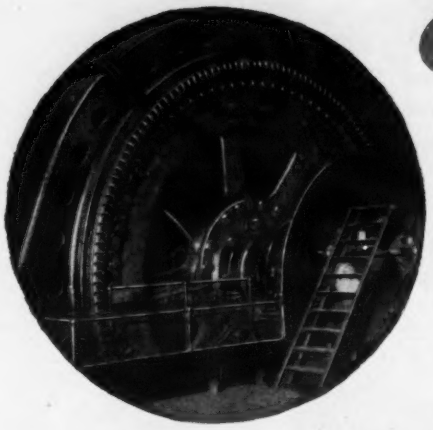
Standard Connectors with 2 Aluminum-Copper Bi-metal Washers for copper to aluminum connections. Sizes: No. 2 solid to 350 MCM. Stranded cable.

"Perma-lok" Connectors with lock washer and spacer for use with copper wires for ever tight connections. Sizes: No. 1/0 to 1000 MCM. Stranded cable.

YLE CORPORATION

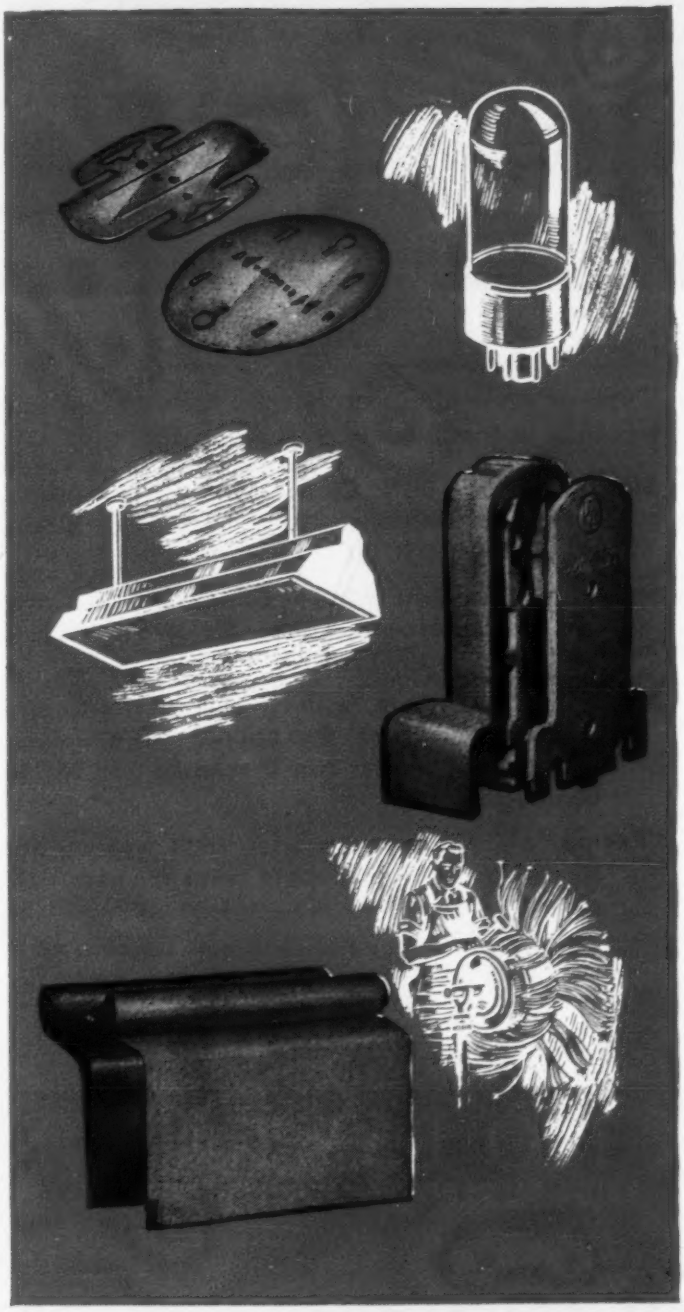
SOUTH MILWAUKEE, WISCONSIN

INSULATION FOR THE ENTIRE INDUSTRY



From Generator

Under the aegis of four time-tested trade names, EMPIRE, MICANITE, LAMICOID, and MUNSELL—insulating products made by Mica Insulator Company have proved their dependability and importance as adjuncts to the development of electricity's spreading horizons. Their performance



OTHER APPLICATIONS: Sound and oxygen diaphragms, aircraft magneto and transmitting condenser films, gauge-glass shields, heating appliance elements.

SHEET MICA—

of which our Munsell Division is one of the largest single importers, is extensively used in the field of electronics, where high frequencies often combine with high operating temperatures. As element supports and thermal guards, their use ranges from small receiver to heavy duty transmitting tubes. Supports shown at left are punched to specification by Mica Insulator Company from high-grade Muscovite mica sheets.

OTHER APPLICATIONS: Coil forms, circuit breakers, bus bar insulation, condensers, panels, terminal strips and blocks, controllers, switch gear insulation, etc.

LAMICOID—

A thermo-setting plastic laminate in sheet, rod or tube form, fabricated with a variety of cloth and paper bases. It has uncounted applications for mechanical, electrical, graphic and decorative uses and is readily machined into intricate shapes. Illustrated is a Lamicoid insulating closure for a fluorescent light bracket, one of many new Lamicoid applications where electrical and mechanical strength requirements combine in the manufacturing field.

OTHER APPLICATIONS: Phase separation, slot and end winding, magneto, ignition and instrument coils, padding and banding cushions, armature ends, etc.

EMPIRE—

The most widely accepted name in varnished cloths and tapes marks the products of Mica Insulator Company exclusively. Cambric, canvas, duck, silk, rayon and Fiberglas, impregnated with carefully selected varnishes and varying in thickness from 2 to 40 mils, offer the manufacturer or designer the widest selection of insulating fabrics for coil wrapping and other similar uses.

to End Use

fulfills, in manufacturing, electronic, maintenance and public utility fields alike, the promise of unvarying quality which these trade names imply.

However diversified your insulating requirements may be—you will find, in the products and facilities of Mica Insulator Company—a supply source equipped to help you meet your needs and to complement your own product research with half a hundred years of irreplaceable experience in insulation.

OTHER APPLICATIONS: Slot cells and troughs, end-bell insulation, coil forms and spools, high-tension terminals and barriers, bushings, washers and other uses.

MICANITE—

Built-up mica—the original and trade-marked product of Mica Insulator Company—consists of thin mica splittings, bonded into composite sheets, rods and tubes. It is almost universally used for V-rings in motors of all sizes, from the largest D. C.'s to the compact, new design fractional horsepower motors for military and postwar civilian use. V-rings can be furnished in one (shown right) or two pieces, or as sectional, fitted rings.

OTHER APPLICATIONS: Stampings for field poles and armatures, punchings, washers or for other uses demanding resistance to elevated operating temperatures, and non-hygroscopic properties.

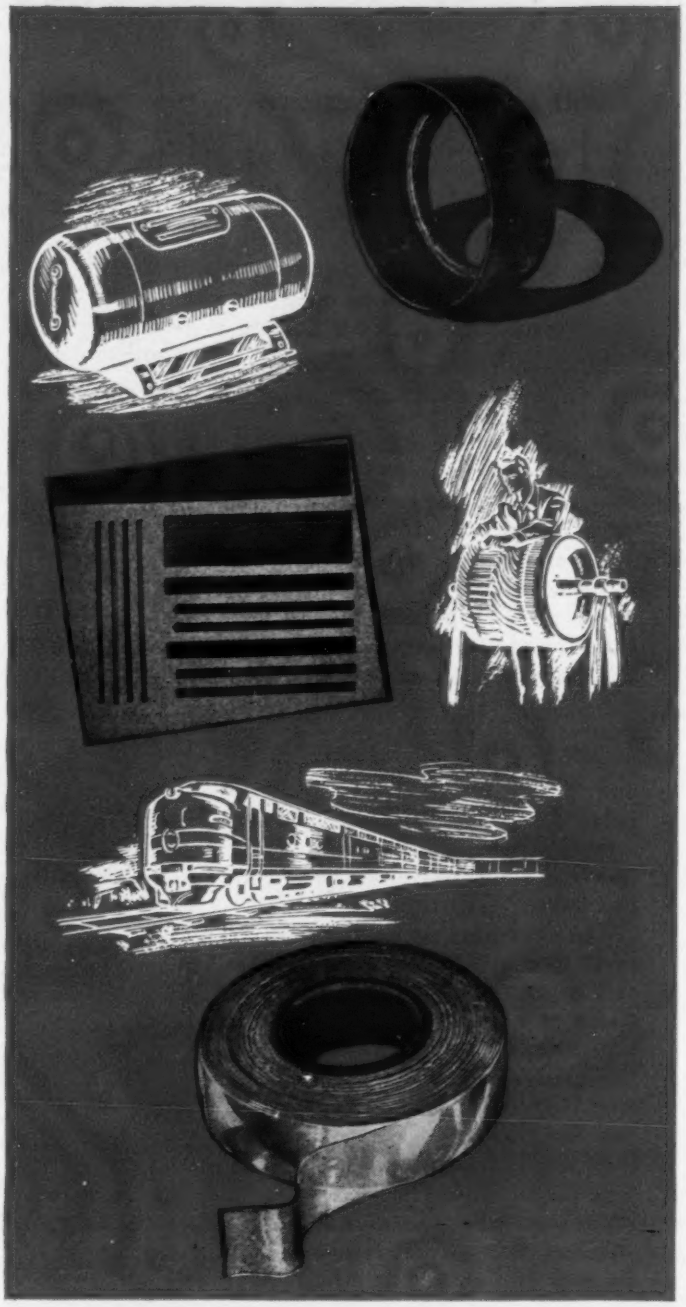
LAMICOID AND FIBERGLAS—

A specialized product of Mica Insulator Company, for use in applications requiring resistance to elevated temperatures. Low moisture absorption and high dielectric strength provide plus protection for motors operating under adverse conditions. Machines well, and is extensively used for slot sticks (illustrated) and end insulation.

OTHER APPLICATIONS: Coil wrapping and end insulation and other uses where space saving, plus good mechanical and electrical strength are important factors.

SILK AND MICANITE—

Composed of mica splittings, faced on both surfaces with silk or with silk on one side and 1-mil condenser paper on the other. The tape (illustrated) is an important insulation in the construction of Diesel-powered locomotives.



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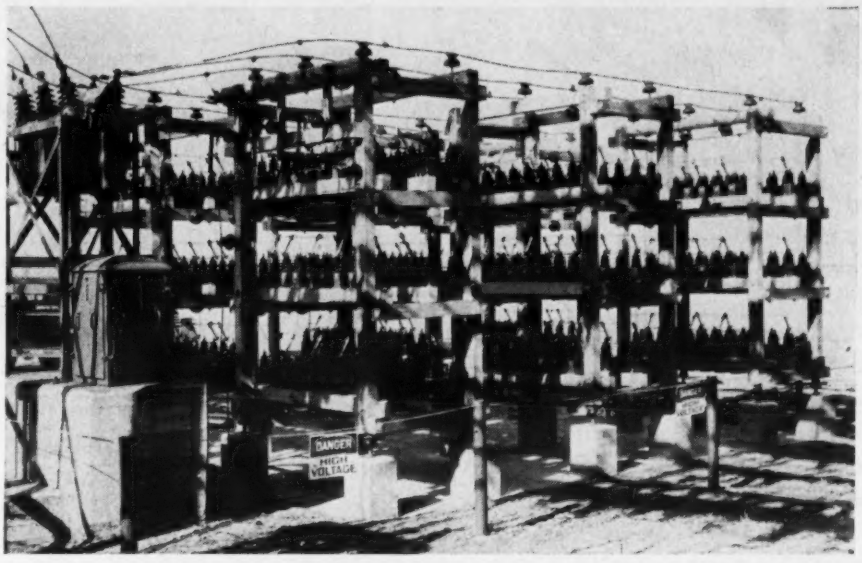


SHUNT CAPACITORS totaling 4,860 kva. connected to 7,200-volt, three-phase bus and mounted on six crossarm frameworks

4,860 Kva. Capacitors Release 2,500 Kw.

By N. P. TAYLOR,
Assistant Chief Engineer,
Kentucky Utilities Co., Lexington, Ky.

Due to substantial war loads added to the Western System of Kentucky Utilities Company a 4,860-kva. shunt-capacitor installation was made at the Paducah, Ky., substation to release generating capacity which was otherwise devoted to the increased rkva. load. It is estimated that approximately 2,500 kw. of generating capacity was made available.

In designing the installation it was recognized that load changes and emergencies at other locations might easily require temporary or even permanent relocation of part or all of the capacitors elsewhere. The most flexible installation was, therefore, determined to require portable units and groups that could be used on either 2,400 or 7,200 volts. This was accomplished by use of 324 standard line type, single-phase, 15-kva., 2,400-volt units.

The capacitors are mounted on six racks arranged in two groups. Each rack contains 54 units and three racks comprise a three-phase group having a capacity of 2,430 kva. Each of the two groups is controlled by a 400-amp. oil circuit breaker. Each rack has three tiers and the 18 units on each tier are connected in parallel, then the three tiers are connected in series across one phase of the 7,200-volt bus. One capacitor fuse is used for each two units. The arrangement is such that the racks can be readily connected for either 2,400- or 7,200-volt operation.

On each tier the capacitor tanks are bonded together, but the entire rack assembly is insulated from ground. Grounding disconnects are provided for each of the two groups, but the ground lead is insulated from the structure. The frameworks consist of standard fir crossarms.

Voltage impressed was approximately 7,300 and the indicated amperes for each group was 235, or a total load of 470 amperes and 5,940 kva. The effective kva. was, therefore, 122 percent of rated kva. and within safe operating limit.

The fuses are inspected daily and no capacitor units have failed since the groups were energized.

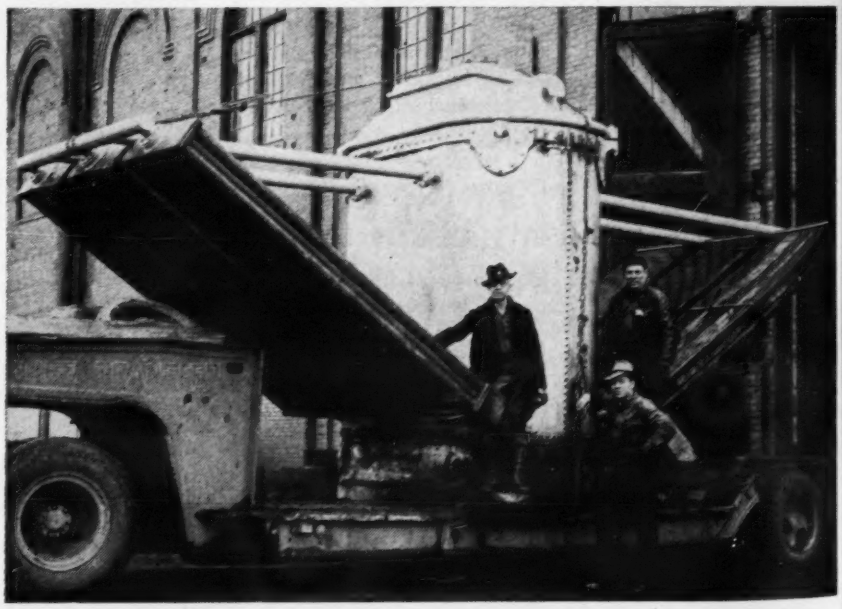
•

"Too Long" Radiators for Old Transformer

During the present scarcity of certain materials it is necessary to keep in operation many pieces of obsolete apparatus which in normal times would be disposed of as scrap. Recently a 2,000-kva., 66/2.3-kv. water-cooled transformer, purchased by the Washington Water Power Co. in 1910, was removed from service and it was desirable that it should be used as a spare transformer, where cooling water was not available.

Radiators, obtained some years ago for another transformer, were on hand but were too long to be mounted in the usual upright position. By means of suitable pipes and headers the radiators were mounted at an angle as shown, resulting in an unconventional appearing transformer. Since the radiators as connected to the transformer resemble the wings of a bomber, the construction men refer to the transformer as the "Flying Swoose."

The idea of this unique radiator arrangement was developed by Earl Baughn, of the Washington Water Power Co., Spokane, Wash. The transformer has been in service and has carried the load satisfactorily.



RADIATORS built for another transformer were adapted to an old water-cooled unit by mounting at an angle as shown

The price you pay may be *big* if that chair of the paper technician remains vacant . . . opportunities for bettering your product, expanding your market, lowering your costs, may be missed . . . profit opportunities may remain hidden.

Developments in essential papers in the past few years have been more important than ever before in the history of industrial paper production. More rigid scientific controls of paper properties have been perfected. New functions for paper have been discovered . . . critical materials have been replaced by paper.

The pattern for still greater progress in essential papers has been formed. Forward-looking manufacturers concerned with present or postwar improvements in products and production processes, are inviting Mosinee paper technicians to fill that "vacant chair" now. Mosinee is ready to help you "make the most of PAPER."

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. B"

Scovill Tube News

Vol. 2 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 2

"Phosphorized Admiralty"—and its dezincification-resistance

The qualities of this condenser tube material as confirmed in actual performance and reported by Scovill engineers

Millions of pounds of Phosphorized Admiralty are now in use in heat exchanger and condenser service — some since 1939 when this Scovill material was first introduced. Phosphorized Admiralty has built up a remarkable performance record and its resistance to dezincification is of a high order.

An explanation of this may be of interest.

The *dezincification-resistance* of Phosphorous bearing brasses is well known.

The *marked influence* of a very small percentage of Phosphorous in controlling this form of corrosion of Brass has been the subject of considerable research. In this connection, much interest has been shown not only in the actual ability of Phosphorized Admiralty and other phosphorized brasses to inhibit dezincification but in the reasons for the beneficial effect imparted to such alloys by Phosphorous.

Several theories have been advanced and much investigational work has been carried out to explain the inhibiting action of Phosphorous in brasses under service conditions which would normally result in dezincification of the metal. This problem will be better understood by a consideration of the properties of Phosphorous and its compounds.

Phosphorous is non-metallic in character and enters into combination with Oxygen to form a series of oxides. From Phosphorous and its various oxides, a number of metal salts may be obtained. With the exception of Sodium and Potassium salts, these metal compounds are, in general, insoluble in water. In some cases, these salts exhibit colloidal properties to some degree. The end product of the oxidation of Phosphorous gives ortho-phosphates and, in the presence of sufficient Oxygen, ortho-phosphates will be found.

One interesting detail in connection with the compounds of Phosphorous is the behavior of Tin and Phosphorous when they are present in the same solution. Tin Oxide in colloidal solution readily takes up or absorbs Phosphates and this reaction usually hastens the precipitation of Tin in a very insoluble form. It was earlier believed that this reaction was entirely of a colloidal nature, but, recently, it has been shown that a definite compound of Tin Phosphate is formed, at least in certain conditions. This particular reaction between Tin and Phosphorous compounds is stressed because it has been noted in a research on the dezincification of brasses that the presence of Tin in itself retards dezincification to some extent; but the addition of Phosphorous (as in Phosphorized Admiralty metal) is necessary to prevent dezincification of the alloy.

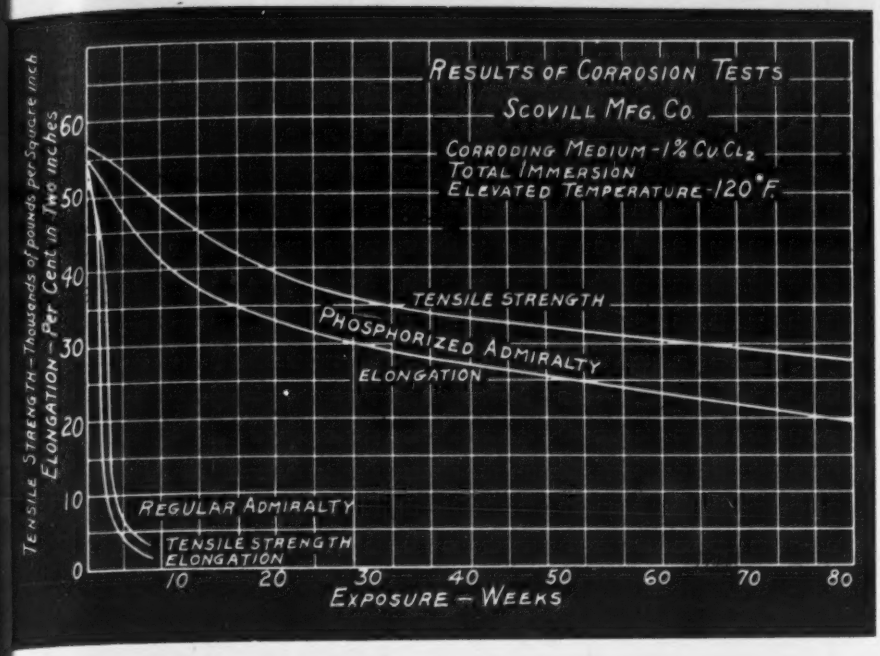
If the foregoing discussion of the formation of insoluble and colloidal metal salts of Phosphorous is remembered, the dezincification-resistant property imparted to Brass by the addition of Phosphorous can more readily be explained. In services where dezincification of Admiralty metal or other brasses has been experienced, the phosphorous content of the dezincification-resistant alloys probably promotes the formation of a protective film (in the nature of a metal phosphate or phosphide such as Copper Phosphide Cu_3P_2), which coats the metal surface at initially corroded areas and arrests further action at such areas.

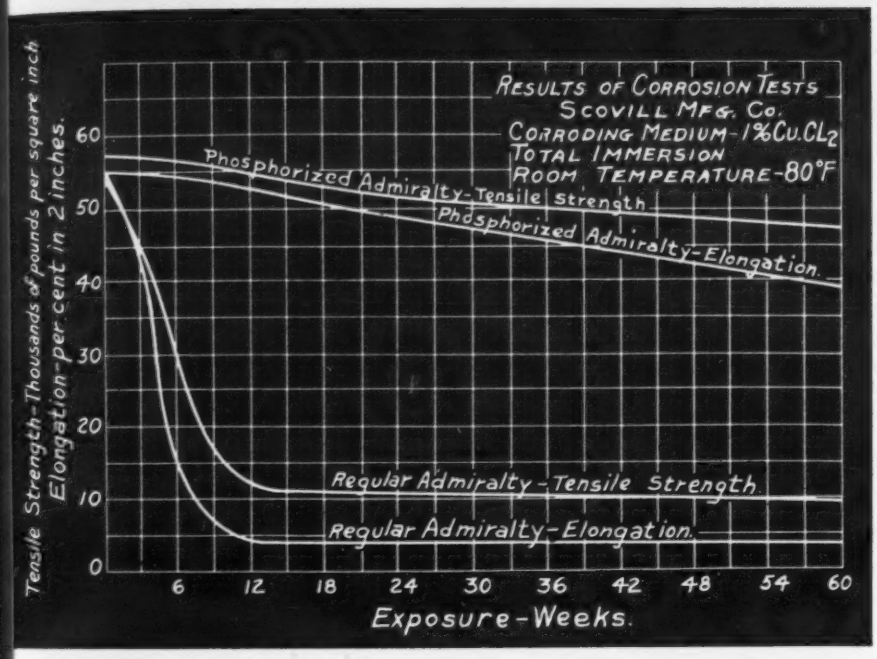
The reactions which take place in the formation of the phosphorous containing film may or may not be complex in nature, as may be anticipated from the above remarks on the chemical reactions of Phosphorous. Thus, in the early stages of corrosion, Phosphorous, together with Copper, Zinc and Tin may pass into solution and the Phosphorous may then combine with certain of the metal ions in solution to form an insoluble compound which coats the metal surface as a stable impervious film. The formation of this compound may involve nothing more than introduction of ions of the reacting elements into the solution, followed by precipitation and deposition of certain combinations of such ions on the metal surface.

It is probable, however, that a more complex series of reactions takes place and may be better explained by considering the existence of colloids in the medium in contact with the metal surface. In this connection, it may be pointed out that very minute quantities of colloids in a solution often times produce a profound change in the behavior of such solutions. In the plating of metals, for example, colloids in the plating bath may alter the type of plate, may prevent plating altogether, or may change the conditions (current density, voltage, etc.) at which satisfactory plating may be carried out. The subject of plating is introduced in this discussion of colloids because dezincification may be looked upon as a plating operation in which Copper is plated upon the brass, usually in the form of a porous, brittle mass. In the case of Phosphorized Admiralty tubes, colloidal Tin Phosphate or other metal phosphates may play an important part in preventing dezincification of the alloy.

This discussion of the part which Phosphorous plays in preventing dezincification of Admiralty metal and other Brasses has necessarily been brief and has been presented only because of the interest which has been shown in this subject.

Wherever dezincification of Admiralty metal tubes has been a serious corrosion problem, the use of Phosphorized Admiralty metal tubes is suggested. This alloy combines the general excellent corrosion-resistant properties of Admiralty metal, a desirable fine grain structure of




RESULTS OF CORROSION TESTS
SCOVILL MFG. CO.
CORRODING MEDIUM - 1% Cu Cl2
TOTAL IMMERSION
ROOM TEMPERATURE - 80°F
Phosphorized Admiralty - Tensile Strength
Phosphorized Admiralty - Elongation
Regular Admiralty - Tensile Strength
Regular Admiralty - Elongation
Tensile Strength - Thousands of pounds per square inch
Elongation - per cent in 2 inches.
Exposure - Weeks.

developed primarily for oil refineries and gasoline plants because in those places the phenomenon of dezincification is pronounced and widespread, it is equally applicable to any situation where dezincification of Admiralty is a problem — particularly at elevated temperatures.

"Phosphorized Admiralty tubes" for condenser and heat exchanger service are covered by patent 2,224,095 and can be legally supplied only by the owner of this Scovill Manufacturing Company patent, or one of its licensees.

Scovill Offers 3 Services to Tube Users

1. Information, like that appearing on these pages, which will help keep engineers informed of recent developments and recent thinking in the matter of condenser tubes. The new "Condenser Tube Booklet" — a part of Scovill's *Service in Manuals* is available, free, from Scovill Manufacturing Company, 24 Mill Street, Waterbury 91, Connecticut.

2. Research in Metals is another Scovill service, intended to establish new knowledge about metal alloys which will help develop better performance on the part of Scovill condenser tubes. Scovill *Service in Metals* also includes the testing of raw materials, the testing of finished tubes before shipment and the analysis of problems arising from tubes in service.

3. Individual recommendations for each customer's requirements constitute the third Scovill service. *Service in Men* brings you a wealth of experience to help you obtain the best results and to eliminate trouble causes.

the finished tubes, favorable physical properties and a very definite improvement over Admiralty metal in its very marked resistance to dezincification.

While Phosphorized Admiralty was

Limitation order L-154 issued by the OPM, limits the use of nonferrous condenser tubes in land power stations to Muntz metal for fresh water plants, and Admiralty metal for salt water plants. No nonferrous metals containing more copper and more tin than these two are permitted by the order.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

HOW TO DETERMINE GEOMETRY OF STANDARD CONDUCTORS

By JOHN L. SKEEHAN, Baden, Pa.

Lay up of a "rope lay" strand or cable starts with a single central wire or strand as a core. Around that core is laid helically a layer of six wires or strands of same size as the core; twelve more on the next layer; then 18, 24, 30, etc. (each layer having six more wires or strands than the preceding layer) are added on succeeding layers.

The result is that there are 1, 7, 19, 37, 61, 91, 127, etc., wires or strands in a concentrically laid strand or cable. This number of strand components of a cable is determined as follows:

The core has one wire or strand
A single-layer strand has (1+6) 7 wires
A two-layer strand has (1+6+12) 19 wires
A three-layer strand has (1+6+12+18) 37 wires
A four-layer strand has (1+6+12+18+24) 61 wires, etc., etc. or by formula (see below).

By the foregoing assembly of wires to form strands:

A single wire is 1-wire diameter
A 7-wire strand is 3-wire diameter
A 19-wire strand is 5-wire diameter
A 37-wire strand is 7-wire diameter
A 61-wire strand is 9-wire diameter
A 91-wire strand is 11-wire diameter
A 127-wire strand is 13-wire diameter, etc., etc.

This table is applicable also for cable (single conductor) constructed of a number of strands or groups of wires.

For example, a 19-strand cable is five strands in diameter and a 37-wire strand is seven wires in diameter. Therefore, a 19x37 cable is (5x7) 35 wires in diameter, measuring in the manner approved by the cable manufacturers, that is, across the longest diameter.

A stranded copper conductor table from a well known manufacturer of wire and cable and formulas for stranded conductor design are included for reference.

A slide-rule method for determining the diameter of stranded conductors will be published in a subsequent issue of this publication.

Concentric Stranded and Rope Stranded Copper Conductors
I. P. C. E. A. Classification

A. W. G. or C. M.	Concentric Stranding					Rope Stranding			Both	
	No. of Strands				Approx. Diam. Inches	No of Strands		Approx. Diam. Inches	Approx. Lbs. per 1000 Ft.	Approx. D. C. Ohms per 1000 Ft. 25°C. (77°F.)
	A	B	C	D		G	H			
5,000,000	169	217	271	271	2.58	1159	1729	2.96	16,000	
4,500,000	169	217	271	271	2.45	1159	1729	2.81	14,400	
4,000,000	169	217	271	271	2.31	1159	1729	2.65	12,700	
3,500,000	127	169	217	271	2.16	1159	1729	2.48	11,100	
3,000,000	127	169	217	271	2.00	1159	1729	2.29	9,500	
2,500,000	91	127	169	217	1.82	703	1159	2.09	7,900	
2,000,000	91	127	169	217	1.63	703	1159	1.87	6,300	.00539
1,900,000	91	127	169	217	1.59	703	1159	1.82	6,000	.00568
1,800,000	91	127	169	217	1.55	703	1159	1.77	5,700	.00599
1,750,000	91	127	169	217	1.53	703	1159	1.75	5,500	.00616
1,700,000	91	127	169	217	1.50	703	1159	1.72	5,300	.00634
1,600,000	91	127	169	217	1.46	703	1159	1.67	5,000	.00674
1,500,000	61	91	127	169	1.41	427	703	1.61	4,700	.00719
1,400,000	61	91	127	169	1.36	427	703	1.56	4,400	.00770
1,300,000	61	91	127	169	1.31	427	703	1.50	4,100	.00830
1,250,000	61	91	127	169	1.29	427	703	1.47	3,950	.00863
1,200,000	61	91	127	169	1.26	427	703	1.44	3,800	.00899
1,100,000	61	91	127	169	1.21	427	703	1.38	3,500	.00981
1,000,000	61	61	91	127	1.15	427	703	1.31	3,150	.0108
900,000	61	61	91	127	1.09	427	703	1.24	2,850	.0120
800,000	61	61	91	127	1.03	427	703	1.17	2,500	.0135
750,000	61 or 37	61	91	127	1.00	427	703	1.13	2,350	.0144
700,000	61 or 37	71	91	127	.96	427	703	1.09	2,200	.0154
650,000	61 or 37	61	91	127	.93	427	703	1.05	2,050	.0166
600,000	37	61 or 37	91	127	.89	427	703	1.01	1,900	.0180
550,000	37	61 or 37	91	127	.85	427	703	.97	1,750	.0196
500,000	37 or 19	37	61	91	.81	259	427	.92	1,600	.0216
450,000	37 or 19	37	61	91	.77	259	427	.88	1,400	.0240
400,000	19	37	61	91	.73	259	427	.83	1,250	.0270
350,000	19	37	61	91	.68	259	427	.77	1,100	.0308
300,000	19	37	61	91	.63	259	427	.71	940	.0360
250,000	19 or 12	37	61	91	.58	259	427	.65	780	.0431
4/0	19, 12, 7	19	37	61	.53	133	427 or 259	.60	660	.0509
3/0	19, 12, 7	19	37	61	.47	133	427 or 259	.54	530	.0642
2/0	7	19	37	61	.41	133	259	.48	420	.0811
1/0	7	19	37	61	.37	133	259	.43	330	.102
1	7 or 3	19	37	61	.33	133	259	.38	260	.129
2	7 or 3	7	19	37	.30	49	259 or 133	.33	207	.162
3	7 or 3	7	19	37	.27	49	133	.29	164	.205
4	7 or 3	7	19	37	.24	49	133	.26	130	.259
5	.....	7	19	37	.206	49	133	.230	103	.326
6	.....	7	19	37	.184	49	133	.210	82	.410
7	.....	7	19	37	.164	49	133	.187	65	.518
8	.....	7	19	37	.146	49	133	.165	51	.654
9	.....	7	19	37	.130	49	.....	.148	40.5	.824
10	.....	7	19	37	.116	49	.....	.132	32.2	1.04
12	.....	7	19	37	.092	49	.....	.105	20.2	1.65
14	.....	7	19	37	.073	49	.....	.083	12.7	2.63
16	.....	7	19	....	.058	....	.....	.....	8.0	4.17
18	.....	7	19	....	.046	....	.....	.....	5.0	6.64
20	.....	7	19	....	.036	....	.....	.....	3.15	10.6

Classes A, B, and C are respectively the standard, flexible, and extra flexible strandings for weather-resistant, slow burning cables.
Classes B, C, and D are respectively the standard, flexible, and extra flexible strandings for cables insulated with Paper, Varnished Cambric, or Rubber.
Class G. For all rubber-sheathed cables for normal use.
Class H. For all rubber-sheathed cables with extreme flexibility.

Formulas for Stranded Conductors*

Let n = number of layers over the core
N = total number of wires in the whole strand
d = diameter of individual wires, in mils
D = diameter of the strand (or circumscribing circle), in mils
D^1 = diameter of solid conductor, in mils

Total Number of Wires:

$$N = 3n^2 + 3n + 1$$

Diameter of Strand:

$$D = d(2n + 1)$$

$$D = \sqrt{\text{cir. mils} \times \left(\frac{4}{3} - \frac{1}{3N}\right)}$$

Total Cross Section:

Cir. mils = Nd^2

Equivalent Solid Conductor (approx.):

$$D^1 = \sqrt{Nd^2}$$

*Standard Handbook for Electrical Engineers, 7th Edition, pages 263 and 264.

SUBSTITUTES MEAN *Progress*

★ Almost daily, you read about, or hear someone speak of something as being a *substitute* for some other product or material whose chief claim to fame and acceptance is traceable only to the fact that "Grandpa used it." The war has accelerated the development of these so-called "substitutes." Time, in most cases, is going to show that they should have been called *improvements* from the beginning. "Fulton's Folly" was a substitute for sail. Edison's incandescent lamp was a substitute for inferior light. Look what the years have done to them.

While we have made very few substitutions at Crescent, the ones made have resulted in better tools. The "war finish" which Crescent has substituted for chrome plate actually provides greater protection against rust and corrosion than did the more glamorous pre-war finish. When the war is over, American tool users will be able to buy the finest tools ever to carry the Crescent name.

If anyone wants to look down on substitutes, that's all right with us. We're glad to look forward and believe that SUBSTITUTES MEAN PROGRESS.

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We are confident that you will find in "Electrical Living in 194X" a valuable tool for selling the idea of *better wiring for better living* to present and future home owners. Send for your copy *now!*

Westinghouse Better Homes Department offers new "Six-Point Advisory Service"

The Better Homes Department welcomes the opportunity of giving authentic technical information on the *proper applications of electricity* which will contribute so much to better living in 194X.

This Six-Point Advisory Service includes free advice on the following important subjects:

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2. Location and arrangement of fixed equipment, for conserving space and attaining maximum efficiency in arrangement of kitchen and laundry work cycles.
3. Accurate dimensions and clearances of equipment to insure proper installation and efficient operation.
4. Access for servicing of equipment—so necessary for periodic inspection and repair.
5. Location of lighting outlets and controls, for greater enjoyment, comfort, and safety in the home.
6. Utility service connections—including location and size of electric wiring, water supply, and drainage lines.

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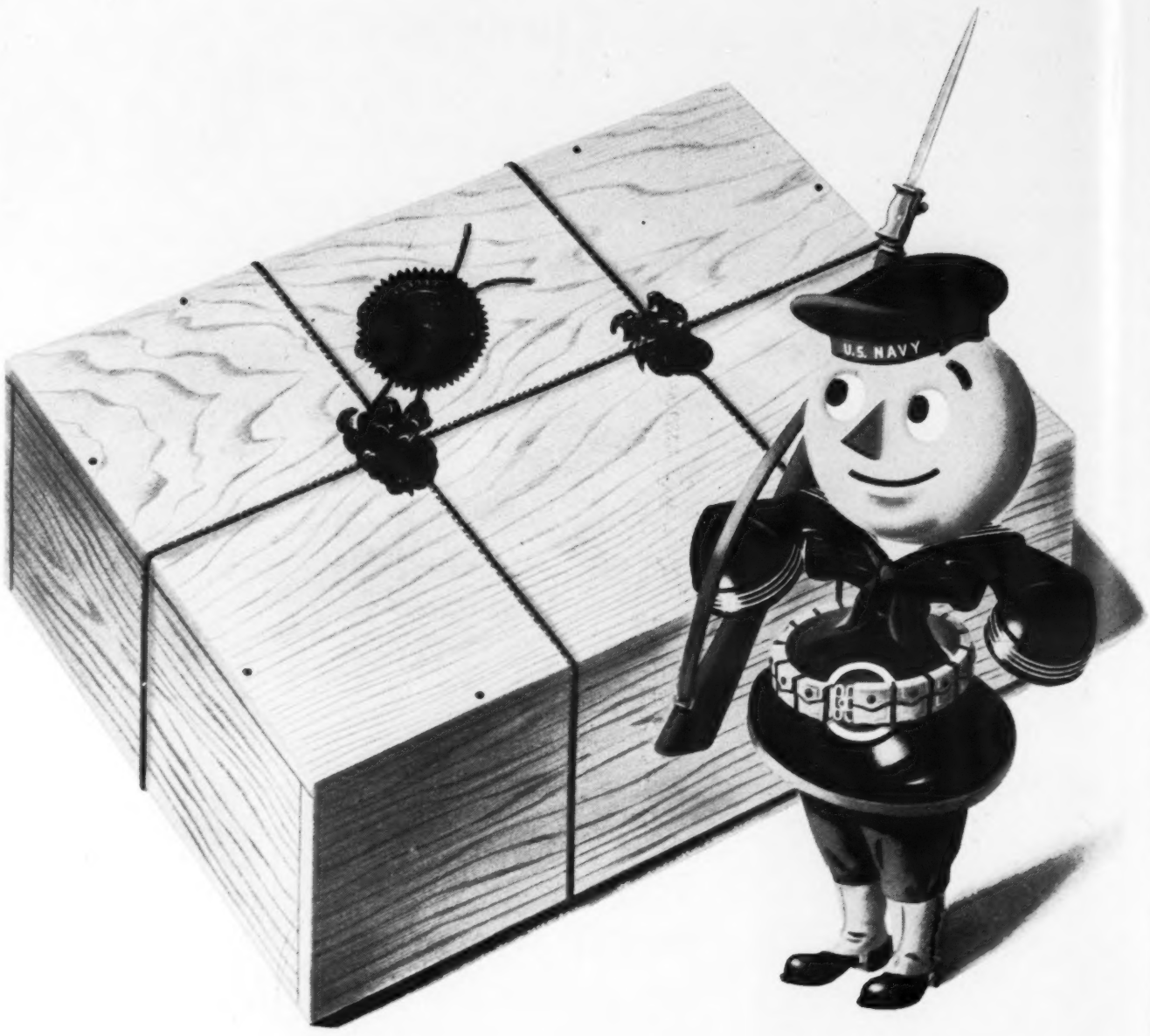

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Sealed in this box and deposited in the vaults of the Bell Telephone Laboratories is a special device that helped win a great battle. It is being preserved for its historical significance.

SUCH things do not just happen. New instruments of war may appear suddenly on the battle-fronts. But behind them are long years of patient preparation.

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Developing secret military devices is a big job but big forces are busy on it, day and night.

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Today's work for war had its beginning many years ago when these laboratories were founded as part of the Bell System's service to the public.

BELL TELEPHONE SYSTEM

Line Surges Cause Burned Slip Rings

By A. E. BRADLEY

Superintendent of Construction and Maintenance
Minnesota Power & Light Co., Duluth, Minn.

Repeated burning at the slip rings of a 7,500-kva., 13,000-volt synchronous condenser, experienced on the system of the Minnesota Power & Light Co., Duluth, in past months was found, on investigation, to have its origin in an inductive effect arising from transmission system disturbances.

The machine in question was connected through a low-impedance autotransformer to a 22 kv. bus. The condenser itself was wye-connected with the neutral ungrounded. Auto-transformer neutral was grounded.

Trouble was first called to the attention of operators by abnormally rapid brush wear. Inspection of the rotor slip rings disclosed burned spots of the same shape as the brushes distributed in groups of four around the circumference of the rings and with spacing corresponding to that of the brushes. Marks were a characteristic black and gray-black.

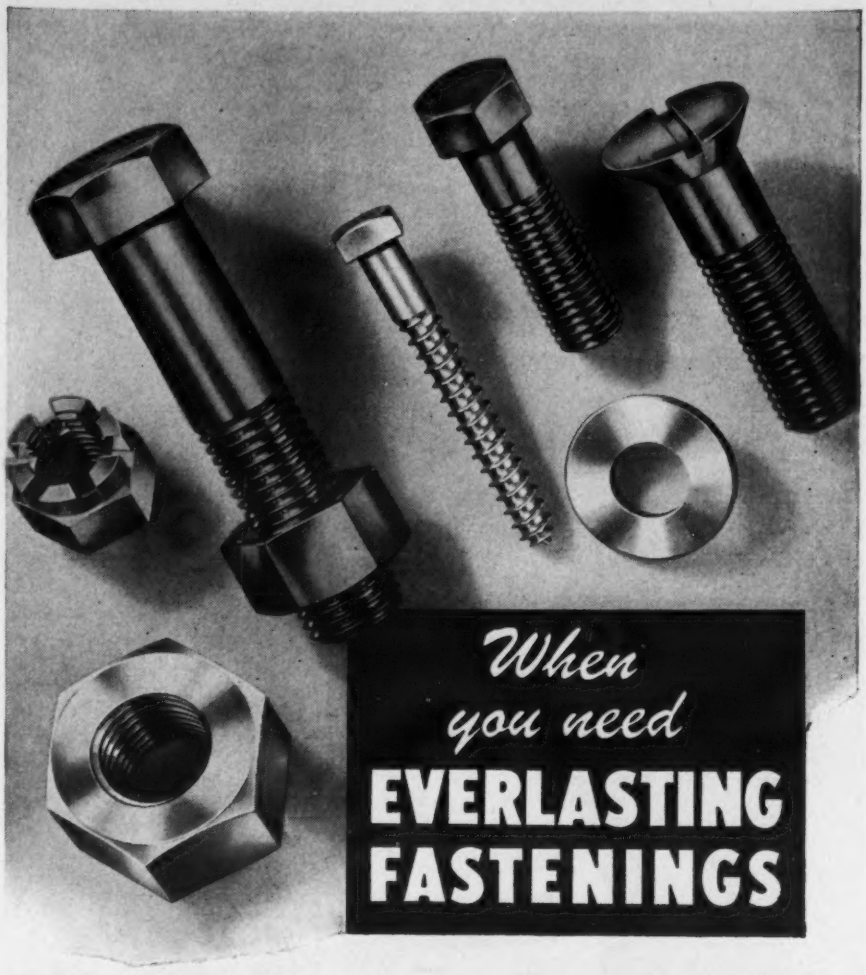
The condition promptly returned after the rings had been turned down and after repairs had been made to damper windings of the machine to correct sparking at the end ring caused by loose connections.

Clue to Difficulty

Loose or burned-off damper winding having been eliminated as a cause, the log of the station was studied for a clue to the difficulty. Here it was found that the new marks on the rings had appeared shortly after heavy surges—lightning—had occurred on the 22 kv. lines leaving the station.

This fact led to the conclusion that the burning was caused by the double-frequency current which would be induced in the field winding when feeding into a single-phase fault. Further consideration indicated that the first half-cycle of a completely displaced wave would be very severe. This heavy current surge passing between the brushes and the slip ring had resulted in local heating under the brush tips, much in the manner of a spot weld, and the burning had resulted.

In searching for a solution, it was found that the original brushes of the machine had been worn out and re-



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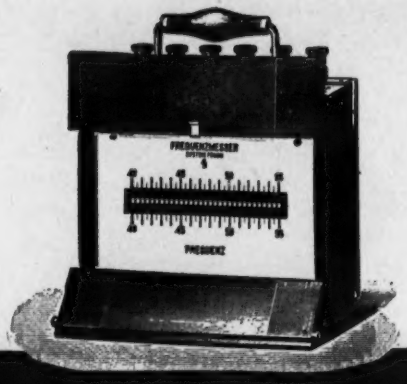
. . . IN 1910

the wood engraving at the right appeared in our first bulletin on Frahm Resonance Frequency Meters.



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Write today for Bulletin 1695-W

James G. Biddle Co.

1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

placed by those of another make but that they were being operated at the original recommended pressure. A check of the machine manufacturer's catalog showed that he had approximately doubled the pressure recommendations for the original brush. The lower brush pressure would cause a higher contact resistance and therefore contribute to the burning. The original brushes were replaced in kind and latest pressure recommendations used. The trouble disappeared and has not returned.

•

Scanner Checks Clocks on Customer's Premises

The accompanying picture shows a scanning device (not a stroboscope) being used to check the speed of a synchronous - motor - driven time switch of the type used to control off-peak electric water heaters.

This scanner was developed at the meter department of the Central Illinois Light Co., Peoria, in the course of a search for some scheme that would permit the field checking of time switch motors on the customer's premises.

Formerly the company brought time switches to the shop if they failed to maintain accurate time. Where a large number of time switches are used this procedure is slow and relatively expensive. It was felt that a check on the customer's property should be made to ascertain if the clock motor was operating at synchronous speed.

To be practical, however, such a spot scheme has to be applicable outdoors as well as in, and under all kinds of light conditions. Devices used must be compact, light, quickly set up and rugged.

The scanning device shown appears to meet these requirements. It consists simply of a 110 volt, 1,800 r.p.m. synchronous motor driving an aluminum watt-hour meter disk having four ¼-in. square notches in its periphery, spaced 90 deg. apart. The disk revolves in its housing between two aluminum disks each having a window opposite the other and so aligned that the disk notches pass between them. With the disk turning at exactly 1,800 r.p.m., a tester peering through the window in the scanning device at the time switch rotor will get 4x1,800 or

New TIPS TOOLS IDEAS FOR OPERATING AND MAINTENANCE MEN

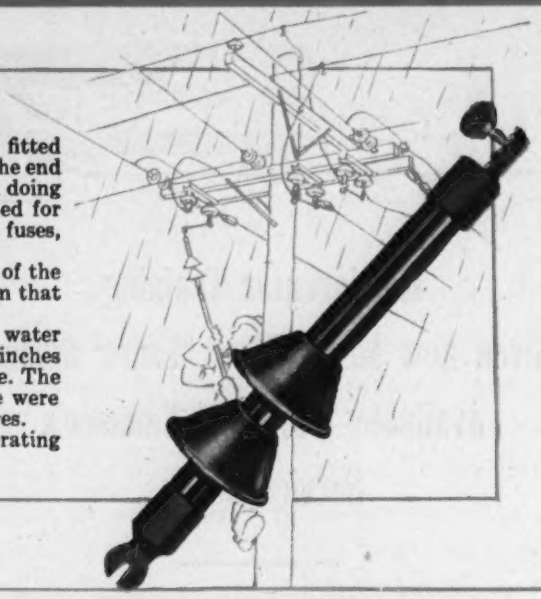
AN EMERGENCY STORM TOOL

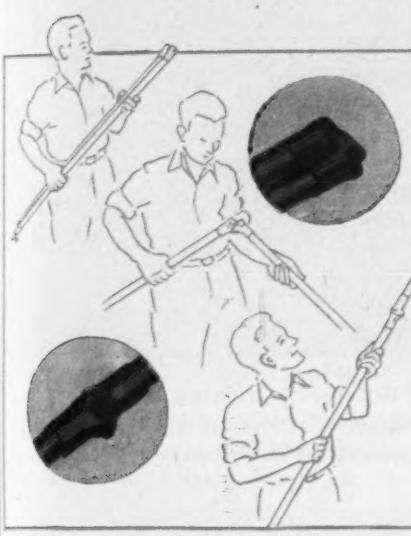
This short pole section covered with laminated plastic and fitted with rubber composition shields, was designed for attaching to the end of a universal hot stick as extra insulation protection to linemen doing emergency work in stormy weather. The end fitting is designed for attaching a variety of small tools, for pulling switches, pulling fuses, applying taps, etc.

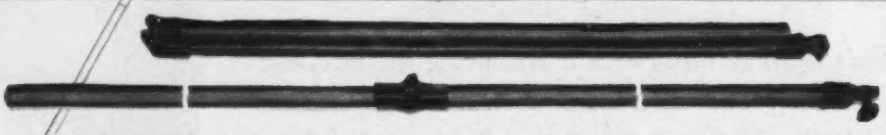
The special hoods are designed to protect the upper portion of the tool from absorbing moisture and to break up any water stream that might otherwise run down the surface of the pole.

Tests were made with this tool under a water spray used for water flashover tests of insulators with water falling at the rate of 0.2 inches per minute at 50 pounds pressure, with the spray at a 75° angle. The tool tested to 48KV before any indications of surface creepage were detectable. The surface creepage registered only 0.1 milliamperes.

At least one such tool should be in every substation, generating plant, or trouble truck for use in extreme emergencies.







HINGED POLE SPLICE FOR "TROUBLE" SHOOTERS

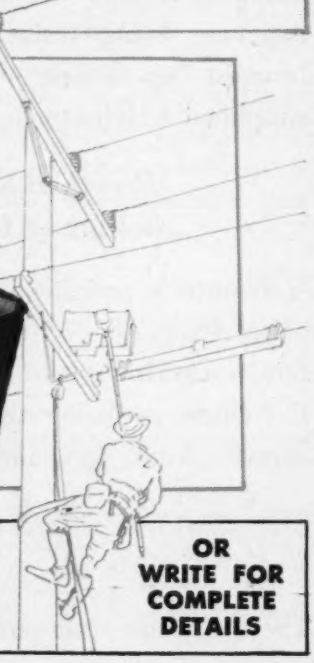
Trouble shooters, service men, superintendents, etc., who like to carry a few tools but are limited for space, find this hinged pole splice to be an excellent idea. It makes short poles out of long ones and may be quickly opened up to full length and held firmly with a spring button. The hinge is released by thumb action and the tool folded up to half its size. The chief safety feature of this splice is that it can not be taken apart. Half the tool can not be used as a short stick with insufficient insulatcn.

The splice may be applied to a variety of hot line tools. Probably the most practical of which is the universal pole shown here with provisions for attaching a number of small tools.

WOOD INSULATING HOODS TAKE THE PLACE OF RUBBER . . .

One answer to the rubber shortage is these wooden insulator and conductor hoods that fit together by a tongue and groove arrangement which permits the insulator hood to fit over the end of the conductor hood without leaving a gap or even a crack for kilowatts to sneak through. These hoods are mounted in place with a small fork-like tool which fastens to the end of a universal pole and slips astride the block provided on the side of each hood.

All boards are tongue and grooved to fit tightly together. Joints are made secure with wooden pins and sealed with special glue. Hoods are treated with pole preservative. These hoods are available in a variety of combinations and for double or single insulators.



A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC INDUSTRIES

CONSULT OUR CATALOG

OR WRITE FOR COMPLETE DETAILS

KELVINATOR SERVICE NOW IN

Refrigerator Training Given New Men—New "Users' Guides" Available—to Meet Summer's Service Needs

This third summer of war will bring the heaviest demand yet for appliance service. In cooperation with the National Appliance Conservation Program, Kelvinator has inaugurated a two-phase program to train needed service manpower, and to enlist customer cooperation when service delays are unavoidable.

Today service representatives of Kelvinator distributors and zones are conducting Service Training Schools throughout the country. New men are being trained and experienced men brought "up to date" with the highly practical, simplified Kelvinator training course.

Practical Service Clinic is Part of Every School!

Kelvinator's training schools teach two phases of servicing. One is the training in refrigeration fundamentals—the other is a service clinic. In the clinic, servicing techniques are thoroughly demonstrated, using actual refrigerators.

Training Material Recognized As Finest Available!

The Kelvinator simplified training course was first offered last year. Called the most valuable service help of 1943 by retailers, it was widely used by prominent utilities, technical schools and dealers. It's factual—it's practical—it's easy to understand. And a complete file of bulletins give in detail the specific instructions in servicing Kelvinator refrigerators and electric ranges. In addition, there is a "Trouble Shooter's Guide" which is most valuable for use as a ready reference concerning the more common service difficulties.

● Typical Kelvinator Training School
Covering fundamentals of refrigeration, using training course, slide film and actual service parts.

Kelvinator Training Schools Held in Every District!

Kelvinator Service Training Schools are being held in most key points throughout the country.

TRAINING SCHOOLS SESSION!

BETTER CARE — Electric Servicemen — LESS REPAIR

● Typical Kelvinator Service Clinic
Where servicing techniques are thoroughly demonstrated, using actual refrigerator.

For information as to the dates in your locality, contact your local Kelvinator distributor or zone. If no school is scheduled convenient for your men, they will be more than willing to form a school wherever attendance warrants it. It is Kelvinator's sincere purpose to help every dealer and service organization solve the manpower shortage and servicing problem.

New "Users' Guides" Made Available!

In an effort to conserve the valuable time of service men, Kelvinator has prepared two new "Users' Guides", one covering electric refrigerators and the other electric ranges. Each tells how to keep the respective appliances operating efficiently—how the user can diagnose minor troubles and make adjustments at home until a trained serviceman is available.

● Complete Kelvinator Material for Every Service Need!

Kelvinator's "Simplified Training Course for Refrigerator Men", the "Trouble Shooter's Guide", and the new "Users' Guides" covering both refrigerators and electric ranges, meet every serviceman's need. See your local Kelvinator distributor or zone for complete information.

The men and women of the Propeller Division of Nash-Kelvinator Corporation have been awarded, and proudly fly and wear, the famous Army-Navy "E" for High Achievement in War Production.

LOOK AHEAD WITH KELVINATOR

DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha · Milwaukee · DETROIT · Grand Rapids · Lansing

Millions OF TINY PARTICLES OF WATER

QUENCH OIL FIRES

Fire caused by flammable liquids comes quickly, unexpectedly. Then any moment a devastating conflagration might spread through the plant . . . unless ample protection has been provided.

FIRE-FOG offers such protection. This newest of "Automatic's" Systems does three things and does them automatically and amazingly well: It *blankets* . . . it *isolates* . . . it *quenches.* Millions of tiny particles of water—forming a mist-like spray—cloak and choke the flames, "island" and cool the fire, extinguish the blaze!

Many months ago "Automatic's" engineers started working on FIRE-FOG. Thousands of dollars were spent in designing, experimenting and perfecting. Today FIRE-FOG is ready for fire guard duty, and when necessary will go into action with a speed that is seemingly miraculous. Best of all, it does quickly the job it was designed to do—*quench flammable liquid fires!*

Want more information? Ask to have an "Automatic" Engineer drop in to see you. There's no obligation.

"AUTOMATIC" FIRE-FOG

★ IT BLANKETS
★ IT ISOLATES
★ IT QUENCHES

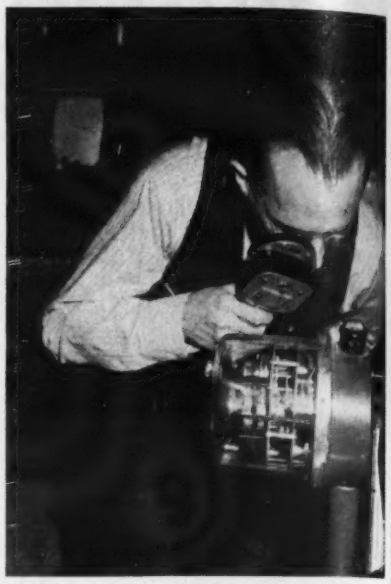
"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA ★ YOUNGSTOWN, OHIO

★ ★ ★ OFFICES IN PRINCIPAL CITIES ★ ★ ★

AUTOMATIC SPRINKLER CORPORATION OF AMERICA RATE OF RISE

TRADE MARK REG U.S. PAT. OFF.

7,200 separate glimpses of the rotor per minute. If the clock rotor is turning at its synchronous speed, its stroboscope reference marks (most manufacturers provide them on the rotor) will appear to stand still. On the other hand if the clock rotor speed is slow, due to friction or dragging of the mechanism, the rotor marks will appear to drop back. If



SCANNING DEVICE being used to verify the synchronous speed of a time switch motor. Device permits periodic spot check of time switches directly in the field

the magnets are weak and the motor runs above synchronous speed, marks will appear to move ahead in the direction of rotation.

Since the scanning device does not depend for its operation upon the projection of a stroboscopic (periodically interrupted) beam of light cast upon the rotor, the light conditions under which the device is used are of no consequence. As long as the operator can see the rotor through the scanning device it can be used. Direct sunlight, a flashlight or any other source of light may be used to illuminate the rotor during the check.

The device used at Peoria is small, being slightly smaller and considerably lighter than the familiar tong type ammeter. It operates on standard lighting voltage, usually readily accesible at time switch locations. It can be built from scrap parts and material commonly found in meter shops. The only vital requirement is that the motor be synchronous and capable of driving the meter disk at exactly synchronous speed.

A Panelyte* LAMINATED PLASTIC PART MAY SOLVE Your Problem

Intricately shaped PANELYTE part used on Wright Cyclone Engines being removed from mold.

Final guage inspection of precision fabricated part, mass produced for Hamilton Standard Propellor Co.

Are you concerned with the design or the mass production of an intricate part? We may be able to save you weeks of experiment . . . and money as well.

Does the application demand light weight . . . high structural or dielectric strength . . . dimensional stability . . . low water absorption . . . resistance to heat and moisture? PANELYTE, the structural plastic manufactured in 35 paper, fabric, wood veneer, fibre glass and asbestos grades, has these properties.

1,235 resin formulations have been developed by PANELYTE engineers, and the majority of the resins manufactured in our own plant. If one of these is not exactly right for your application we will develop one.

Production snags? Proved PANELYTE molding and fabrication techniques permit straight-line *mass* production of intricate parts.

Design difficulty? PANELYTE engineers, credited with significant advances in mechanical and structural design, will be happy to work with you. Check with us on *any* question involving the use of laminated resinous plastics.

Write for PANELYTE Data Book.

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Trading Post Speeds Appliance Exchange

The tempo at which used appliances are changing hands in the Fond du Lac district office of the Wisconsin Power & Light Co., has jumped considerably since the installation there of the "Reddy Kilowatt Trading Post" shown in the accompanying picture.

RUSTIC TRADING POST speeds tempo of appliance exchange. M. R. Norton, district sales supervisor and Jeanette Kaufman, junior clerk at the Fond du Lac trading post of Wisconsin Power & Light Co.

Intent of the trading post, which was designed by Fred Whitley, district manager and M. R. Norton, district sales supervisor, is to help customers by giving more publicity to the company's two-year-old plan of providing a place where they could buy or sell old appliances, secure information about appliances and get their worn-out appliances repaired in their immediate vicinities.

During its first three weeks, publicity about the trading post fostered the sale of 19 appliances from listings. Eight more appliances were sold for customers who brought them in. During the same three weeks, 104 appliances were listed for sale and 21 others were brought in by customers. Requests for appliances, however, still far out-number those offered for sale, the company reports.

Similar trading posts are now in operation throughout the entire territory of the Wisconsin company, in co-operation with the National Conservation Program and the National "Better Care Less Repair" Program, and are meeting with considerable success.

Operation

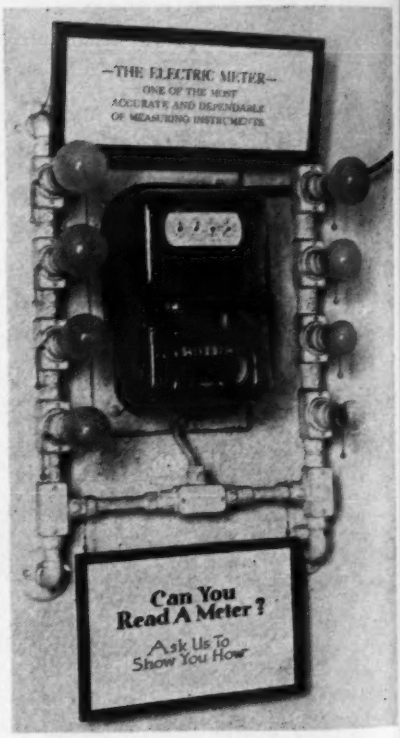
Operation of the trading posts is as follows: When a customer lists an appliance for sale, phone calls are made by the company to all customers who are listed as wanting that type of appliance. Similarly, when a request is made for a used appliance the customer is given the name, address and telephone number of those who have a device for sale. The actual sales transaction is conducted directly between the potential purchaser and owner. The company does not participate beyond bringing the interested parties together.

Blackboards used in the trading post displays are made of wallboard. Frames are of 2-in. cedar fence post coated with shellac. The rustic atmosphere of the post is heightened by displays of muskrat and fox pelts, deer antlers and a Newfoundland dog-skin rug which were loaned by interested customers and company employees.

•

Meter Aids in Bill Adjustments

A compact set-up to illustrate features of meter reading for customer benefit in the interviewing section of Boston Edison's adjustment division has been found useful in connection with discussions of high bills and other matters relative to service. It occupies about 2 ft. 3 in. x 1 ft. 6 in. of wall space in the main offices, being wired in ⅜-in. conduit and made up of a watt-hour meter in the supply circuits feeding eight lamps ranging in size from 10 to 100 watts. Each lamp has a pull chain socket as shown, and the effect on the meter of connecting lamps in any desired combination or singly can instantly be demonstrated. At the top of the right hand column, an old 60-watt lamp with blackened bulb has been purposely provided to allow the obvious lesson to be pointed out to customers. The effect of varying loads can read-



METER SET-UP for customer benefit

CELLULOSE ACETATE is big in the electrical news today. Designers and engineers have new appreciation of its corrosion-resistance properties—its high dielectric strength.

Lumarith, in foil and film form, is the safe lining and covering for coils, tubes and bobbins. It has no corrosive effect on current-carrying copper wire even in the presence of moisture. It has good resistivity and high dielectric strength. Electrical equipment, subject to extreme conditions of moisture and humidity, will benefit from this extra protection Lumarith can supply.

Investigate the electrical possibilities of Lumarith plastics. Write for Celanese electrical booklet. The facts you'll need are available in its pages. Celanese Celluloid Corporation, *The First Name In Plastics*, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16. *Representatives:* Dayton, Philadelphia, Cleveland, Chicago, St. Louis, Detroit, Los Angeles, Washington, D. C., Leominster, Montreal, Toronto.

LUMARITH PLASTICS IN FILM..FOIL..MOLDING MATERIALS AND OTHER FORMS

TUNE IN Celanese* Hour—
*"Great Moments in Music"**—
Columbia Network,
Wednesdays, 10 P. M., E. W. T.

LUMARITH*
A CELANESE* PLASTIC

*Reg. U. S. Pat. Off.

HI-VOLTAGE

C-W
Air Break
SWITCHES

protect your service under the most severe operating conditions

● Top illustration shows the hinge end of a C-W Switch made during an ice test. The switch was warm, approximately 70°, when the spray was started and the ice deposit represents a six hour accumulation. A gradually applied pull of 60 lbs. on a 28 inch lever cracked the ice at the hubs of the cranks and freed the mechanism.

The lower picture shows the switch closed into contact through a heavy deposit of clear ice. The switch was closed at the speed of motor operation. This contact housing is not only a sleet hood but is also designed for ice breaking.

For dependable protection specify Hi-Voltage Air Break Switches.

HI-VOLTAGE
EQUIPMENT COMPANY
2891 East 79th Street • Cleveland 4, Ohio

ily be shown with the wattage being increased or reduced to correspond with the requirements of practically any type of appliance under discussion. Explanation of creep vs. registration, normal drift of the meter disc, and the effect of high-resistance grounds when actually demonstrated are usually within the grasp of the most non-technically minded customer. While it is recognized that such a demonstration is not a cure-all for high bill complaints, the installation serves to explain through visible evidence many electric service problems not generally understood by the public.

•

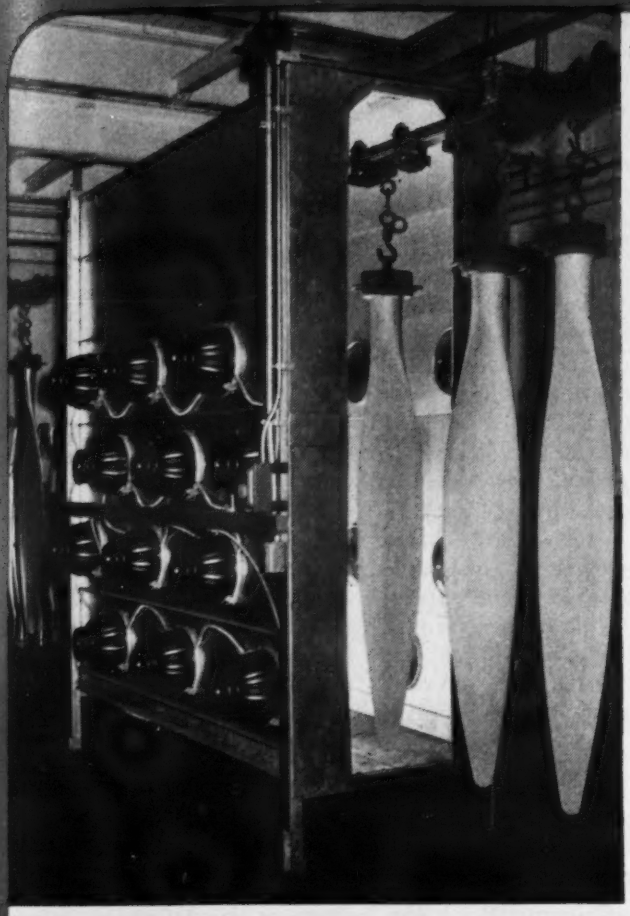
Service in 1.5 Days After Mill Accident

The 22-ft. flywheel of a 52-year old 600-hp., Corliss twin engine at the Talbot Mills, No. Billerica, Mass., exploded recently as the result of a shaft break in an idler carrying a 42-in. belt 180 ft. long to the mill's main drive shaft. The idler broke the belt, which was running at nearly 5,000 ft. per minute, and was carried against the flywheel rim. There was no loss of life and but one minor injury to employees, thanks to a change in shift which had just occurred. The engine was wrecked and considerable damage done, but a call upon the Lowell Electric Light Corp., which supplied a portion of the power used by the mill, led to the restoration of substantially full power facilities in about 1.5 days.

Combination of Power

Before the accident the power requirements were met by a combination of hydro, engine and motor driving under which a portion of the electrical energy was purchased from the Lowell company at a 600-kva. transformer bank in the mill yard. Two water wheels operating under a 10-ft. head from the Concord River and the Corliss engine (each cylinder 22-in. x 48-in., 100 psi., and a speed of 72 r.p.m.) drove a jack shaft in the mill basement. From this shaft some machinery requiring about 100 h.p. and a 300-kw., 575-volt generator were belt driven. (New electrically driven machinery has been ordered which will replace the present 100-hp. mechanically driven load. The plant will

Infra-Red Radiant Heating Equipment ... Engineered for Efficiency



• Among the practical innovations developed by C. M. Hall Lamp Company — developments which set the pace and have become standard practice in use of infra-red as a production tool — are the following:

• • •

COMPLETELY ENCLOSED OVENS PERMITTING FULLEST USE OF HEAT—BOTH RADIANT AND DERIVED CONVECTED HEAT, THIS ASSURES BETTER TEMPERATURE CONTROL.

PREFABRICATED PANEL CONSTRUCTION TENDING TO SIMPLIFY ERECTION AND TO REDUCE OVERALL COST.

REMOVAL OF ALL VITAL PARTS AS: WIRING LAMP BASES, AND SOCKETS FROM THE HEAT ZONE TO OUTSIDE THE OVEN ENCLOSURE THEREBY REDUCING MAINTENANCE COST.

POSITIVE VENTILATION CONTROL THROUGH THE USE OF EITHER A RECIRCULATION OR AN EXHAUST SYSTEM.

• • •

EXCLUSIVE HALL FEATURES **are built into equipment employing radiant heat sources varying from 250 watts to 1000 watts.**

Being the product of extensive modern manufacturing facilities and mass production techniques, completely enclosed ovens employing 1000 watt infra-red lamps are now available at a basic price of $40 per kilowatt.

Of equally high quality and as carefully designed to meet an even broader field of manufacturing problems is C. M. Hall Lamp Company's 250 watt equipment which is available at a basic price of $20 per kilowatt.

C. M. HALL LAMP COMPANY INVITES *YOUR* QUESTIONS AS TO HOW INFRA-RED RADIANT HEATING EQUIPMENT MAY SOLVE *YOUR* HEATING PROBLEM.

INSTANT

C.M. HALL LAMP CO.

HEAT

1035 EAST HANCOCK ST. DETROIT 7, MICHIGAN

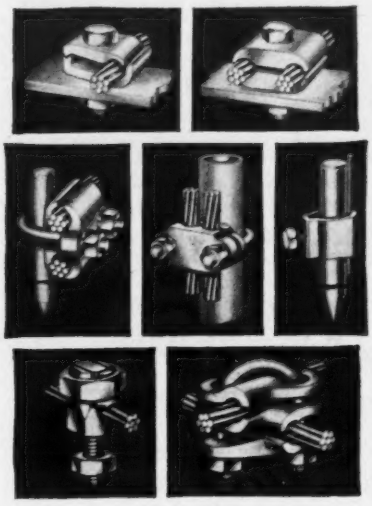
"You can get **ANY** Grounding Connector—

—in the **COMPLETE** line."

The pictures below can only give you an idea of the variety, because **Penn-Union makes ALL good types.**

Write us for any grounding connector, clamp or stud . . . for all combinations of pipe, rod, flat bar, cable, braid, tubing.

Every one a *dependable* unit of protection for personnel and equipment . . . of ample capacity, high mechanical strength, and resistant to corrosion.



Also the most complete line of Service Connectors, Cable Taps, Terminal Lugs, Tees, and other fittings. *Penn-Union connectors are the choice of leading utilities, industrials, contractors and electrical manufacturers.* Write for Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

then be 100 percent electrified.) About 1,500 hp. in connected motor load was installed, supplied at 575 volts three-phase, and the mill also used 87 kw. in infrared heating, besides 120-volt lighting service. The demand was about 750 kw. on the day shift and 600 kw. on two other shifts.

Utility's Quick Connections

The Lowell company immediately transferred an available bank of three 333-kva. transformers from one of its substations about a mile away to the mill yard substation, removing the three 200-kva. transformers at the mill. Quick connections were made with the utility's 13-kv. feeder serving the mill. Changes in the outdoor set-up were made to care for metering increased load, including a 3-ft. x 3-ft. x 9-ft. wooden compartment covered with tar paper to house the larger equipment, care for the related bus connections, and provide the greater power delivery to the mill without overloading the existing connections from the transformers. Previously the mill had been served by two 400,000-cm., 575-volt, underground cables from the yard substation. These were retained in service, but were supplemented by a 575-volt overhead circuit about 60 ft. long, which was run across the yard to the mill, and connected inside to supply the wet finishing department and the mill lighting approximately 300 kva. The utility installed three 500,000-cm. conductors for this purpose, taking off from a wooden extension arm attached to the framing of the substation arbor and terminating on strain insulators fastened to the mill wall, with drop leads to a conduit fitting carrying the wires through the mill wall.

Generator Used as Motor

The destruction of the engine left the mill shaft with the two small waterwheels as prime movers. It was decided to utilize the former belt-driven generator as a 400-hp., 575-volt synchronous motor, running it with purchased energy, and the connections were so made. The waterwheels are employed to bring this machine up to synchronism with the utility system, after which it provides the required drive for the machinery run from the mill shaft. The mill boiler plant continues to supply process steam for the manufacture of woolen cloth. The matter of future power supply is to be investigated from the usual engineering, operating and economic angles; but the speed with which emergency service was provided made it possible for the mill to continue the production of war material with only a relatively brief interruption of manufacturing.

• • •

Maintenance Chart for Farm Appliances

REMINDER LIST OF EQUIPMENT TO BE OILED

CHECK LIST	Equipment	Mfgr. Recommends	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Water systems														
Pumps														
Sump pump														
Washing machine														
Clothes drier														
Ironer														
Refrigerator														
Freezer														
Dishwasher														
Kitchen mixer														
Vacuum cleaner														
Kitchen ventilator														
Portable fans														
Attic fan														
Oil burner														
Coal stoker														
Blower and motor														
Sewing machine														
Electric shaver														
Separator														
Churn														
Ice-cream freezer														
Milking Machine														
Milk cooler														
Bottle washer														
Incubator														
Brooder fans														
Clippers														
Sheep shears														
Barn ventilating fans														
Irrigating pump														
Feed grinder														
Feed mixer														
Corn sheller														
Elevators														
Hoists														
Wood saw														
Tool grinder														
Lathe														
Battery charger														
Paint sprayer														
Other shop motors														
Portable motors														

TO GUIDE its farm customers in the maintenance of farm electrical equipment, Northern States Power Co. is distributing this reminder list of equipment to be oiled. The check chart was adapted from the magazine *Electricity on the Farm*

CHASE ANTIMONIAL ADMIRALTY*

Condenser tube service records reveal that Chase Antimonial Admiralty is extraordinarily resistant to dezincification. In fact, not one failure from this cause has been reported — and there are millions of pounds of Chase Antimonial Admiralty tubes in use, some of them since 1935.

Yet the longer service life you get from Antimonial Admiralty adds nothing to the initial cost of the tubes. You pay no more for Chase Antimonial Admiralty than for plain Admiralty.

REMEMBER these three points about Chase Antimonial Admiralty. It is (1) extraordinarily resistant to dezincification; (2) virtually immune to stress-free intercrystalline corrosion; (3) costs no more than plain Admiralty.

Just phone the nearest Chase Sales Service Office for full information on Antimonial Admiralty.

*U. S. Pat. No. 2,061,931

CHASE

SPECIAL STOCKS OF ANTIMONIAL ADMIRALTY at HOUSTON LOS ANGELES NEW ORLEANS SAN FRANCISCO TULSA

CHASE BRASS & COPPER CO.

—Incorporated—
Waterbury, Connecticut
A SUBSIDIARY OF KENNECOTT COPPER CORPORATION

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO
CINCINNATI CLEVELAND DETROIT HOUSTON
INDIANAPOLIS† KANSAS CITY, MO.† LOS ANGELES MILWAUKEE
MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK
PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER†
SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON†

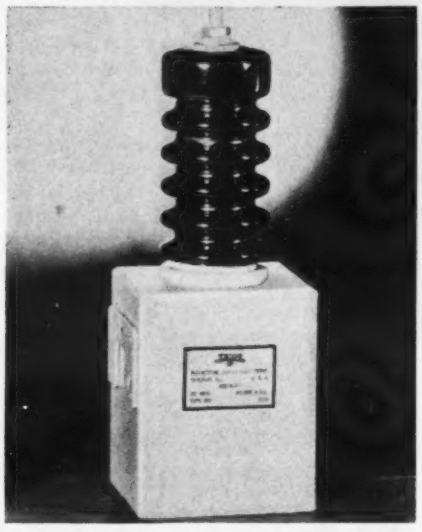
† Indicates Sales Office Only

This is the Chase Network—handiest way to buy brass

NEW EQUIPMENT

Capacitor

Two features of capacitor are stated to be its capability of continuous operation at 80 deg. C. and withstanding total submersion and heavy surges. Case is welded steel measuring $4\frac{1}{16}$ x $5\frac{3}{4}$ x 7 in. high with a stand off insulator $8\frac{1}{2}$ in. high. Insulator is the Westinghouse solder seal type, soldered directly to the case, to eliminate possibility of oil leakage or entrance of moisture. The capacitor was built for use with an electron microscope.

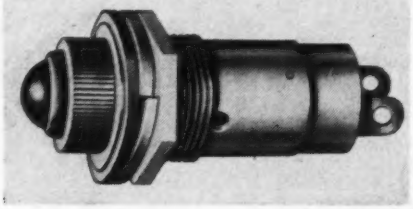


Type "WD" capacitor: 0.01 mfd., 40,000 volts d.c. **Industrial Specialty Co.**, 1725 West North Ave., Chicago, 22, Ill.

•

Pilot Light

Primarily for ungrounded panels, all various models of a new light are equipped with two solder terminals. Different models take long and round bulbs. Lamps are removed from front of panel. In a shutter-type light a 90-deg. turn of the shutter provides gradation from bright light, through intermediate glows to a dim glow, or total blackout.



"Series No. 1110" totally inclosed pilot light: all models mount in a 11/16-in. hole and have ½-in. plain or faceted jewels, also polarized lens. **Gothard Manufacturing Co.**, Springfield, Ill.

•

Insulation Tester

Electronic winding-insulation tester: for insulation not designed to withstand more than 10 kv. Special Products Division, **General Electric Co.**, Schenectady, N. Y.

Testing unit consists of a repeating-type, surge-voltage generator, a cathode-ray oscilloscope, and a synchronously driven switching equipment. It is designed for production-line testing of faulty insulation and winding dissymmetries in a.c. and d.c. motors, generators, coils, and transformers. The instrument is said to test simultaneously turn-to-turn, coil-to-coil, and coil-to-ground insulation and simulates qualitatively such procedures as resistance, impedance-balance, turn-balance, and complete high-potential tests with one voltage application. Divergence between two waves on oscilloscope indicates the presence of faults.

•

Absorbent

"Speedi-Dri" and "Sol-Speed-Dri" grease and oil absorbent. **Refiners Lubricating Co.**, 601 West 26th Street, New York, N. Y.

Former is a compound for spreading around to absorb oil or grease. Latter is a companion product to use when water is present or where soluble oils are employed. They are used in plants around transformers, filters, potheads, pumps, and repair shops, and contain abrasive to reduce danger of slipping. It is stated that the absorbents form no "build-up" of accumulated oil and are fire resistant.

•

Slide Rule

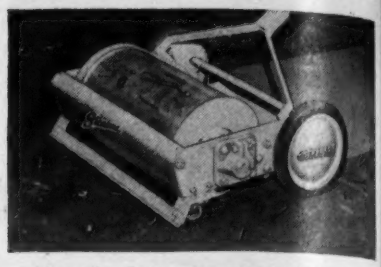
"Monitor" circular slide rule: 6 in. diameter; front side has Log, C, D, and CI scales; reverse side has sine, tangent, A and B scales; leatherette case available. **Tavella Sales Co.**, 27 West Broadway, New York 7, N. Y.

Convenient size slide rule has graduated black lines on white vinylite, is grease and waterproof, and if soiled can be cleaned by washing with soap and water. Length of multiplication, division scale is 13.8 in. Average accuracy is stated to be within one-quarter of one percent.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Floor Sweeper

For collecting metallic floor refuse, portable sweeper has a permanently magnetized drum driven by gear from main wheels.



Magnetic floor sweeper: revolving drum, 18-in. working face. **Stearns Magnetic Mfg. Co.**, Milwaukee 4, Wis.

The unit has anti-friction bearings and requires little more effort to operate than a lawn mower.

•

Diesel Engines

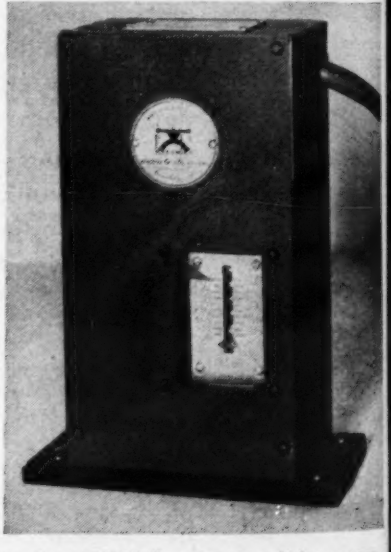
"Series 50" diesel engines: 4-stroke cycle, with 12-in. bore and 15-in. stroke; normally rated 83.3 hp. per cylinder at 500 rpm; stationary and marine service. **Joshua Hendy Iron Works**, Sunnyvale, Calif.

New design of diesel engines features both engine bed and cylinder block of welded steel construction, dual intake and exhaust valves, oil-cooled pistons, precision-type bearings and automatic lubrication. Unit-type fuel pumps and injectors combine with overhead camshaft to reduce the number of working parts. Valve and rocker-arm design are said to insure valve seating without side thrust on the valve steams, and reduces valve adjustments in service.

•

Pressure Switch

Unit is equipped with a direct action gage for hydraulic pressures, operating an electric switch. Pipe connections are made at rear of switch housing. Electric circuit can be used to operate valve or sound alarm.



Type "H-3-2a" pressure switch: pressure ranges from 5 to 5,000 lb. dimensions 10x7x3 in. **Hercules Electric & Mfg. Co.**, Inc., 2416 Atlantic Ave., Brooklyn, 33, N. Y.

A Case of Identity

REQUISITES FOR LIGHTNING ARRESTERS

1. High Protective Level
2. Ability to Carry Heavy Surge Current
3. Good for Both Long and Short Wave
4. No Breakdown on Normal Current
5. Moisture Proof *
6. Operate in All Climates
7. Long Life
8. Field and Laboratory Success
9. Ability to Prevent Line Lock-out
10. Operating Characteristics Unchanged Over Long Service

The men illustrated above are three Electrical Engineers and a Purchasing Agent. These men collaborated in preparing the list of "Requisites for Lightning Arresters" shown at the left. The list was recently published and distributed by a leading Electrical Trade Paper.

*No. 5 was unanimously voted most important.

OPERATING MEN ASK FOR IT!
HUBBARD AUTOGAPS HAVE IT!

Hubbard Autogaps Have the Answers

- Yes! Rapid operation — characteristics are fixed. Breakdown point 55% of insulation strength of equipment.
- Excellent! In excess of 65,000 Amperes of surge current without failure.
- Yes! Handles Long and Short Waves with equal ability.
- No! Gap settings are above possible 60 cycle voltages.
- Better than moisture proof. Design characteristics for Expulsion Type Arrester not affected by moisture.

6. Yes! High and low altitudes — high and low temperatures have not affected good performance.
7. Yes! Made entirely of time-tested, durable material — virtually unaffected by each operation.
8. Excellent laboratory performance confirmed by several years field experience.
9. Yes! Multiple gaps in series containing *no fusible material.*
10. Field experience proves unchanging values over long period of service. Oscillograms are available.

In other words . . . these four men might well have written a single word on their list . . . "Autogaps"

HUBBARD AND COMPANY
PITTSBURGH . . . OAKLAND CALIFORNIA CHICAGO

PERMAFLECTOR INDUSTRIAL

DUALIGHTS

DOUBLE THE LIGHT FROM PRESENT OUTLETS

They are doing yeoman service in war plants where "good seeing" is vital; are available on priority only – normal delivery. For general plant illumination, for localized lighting of production lines, assembly benches, inspection tables. They provide light APPROXIMATING THE IDEAL in maximum QUANTITY and optimum QUALITY – give a DAYLIGHT EFFECT.

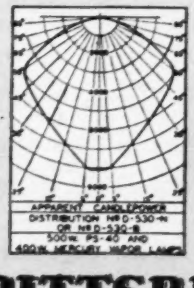
Permaflector DUALIGHTS can be quickly, easily, inexpensively installed–supply over twice as much light without increasing the number of outlets. Each twin-hanger unit is tapped for ¾" conduit stem . . . is equipped with removable plate to simplify wiring . . . with Mogul sockets, safety holders, retaining rings, and appropriate Permaflectors for high or low bay installation.

***No. D-530-N: for Broad Distribution, with No. E-530-GA Permaflectors for 500-watt PS-40 and 400-watt T-16 Mercury Lamps.**

***No. D-505-N: Semi-concentrated distribution, with No. I-505-GO Permaflectors for 500-watt PS-40 and 400-watt T-16 Mercury Lamps.**

No. D-005-N: Semi-concentrated, with Permaflector No. I-1005-GO and No. I-505-GO for 1000 or 750-watt PS-52 and 400-watt T-16 Mercury Lamps.*

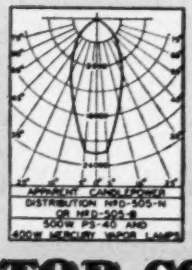
***Also available without retaining ring and strap supports, and at a lower cost as D-530-B, D-505-B and D-005-B.**



PERMAFLECTORS – "shaped mirrors" of silvered glass provide engineered light control for Broad, Medium, or Concentrated Light Distribution.

****400-watt T-16 Mercury Lamp produces 40 lumens per watt – or slightly more light than the 750-watt PS-52 Incandescent –(Light is blue-green in color.)**

Sold thru Electrical Wholesalers



PITTSBURGH REFLECTOR CO.

For Over A Third of A Century — ILLUMINATING ENGINEERS—DESIGNERS AND MANUFACTURERS OF LIGHTING EQUIPMENT—FOR EVERY COMMERCIAL AND INDUSTRIAL LIGHTING SERVICE

OLIVER BUILDING PITTSBURGH, PA.

★ **WAR BULLETIN** Although practically our entire facilities are devoted to producing special, confidential lighting equipment on prime contract for the Armed Forces, we are supplying our industrial customers on priority and our commercial customers with replacements, when possible, from stock. Startling new developments by our Engineering Department, soon to be announced, promise a better future for the commercial lighting field.

SEE YOUR DISTRIBUTOR OR WRITE FOR COMPLETE DATA ON DUALIGHTS

TECHNICAL LITERATURE

"THE NOISE PRIMER"—Prepared for the engineers and executives interested in noise problems. It defines the manner of decibel measurements by the Sound-Lever Meter. Included also are charts, diagrams, tables, and a handy scale of sound levels for typical noise sources. Published by General Radio Co., Cambridge 39, Mass.

STEEL CONDUCTORS—Physical properties, ruling spans and other data in graphic form have been prepared to assist engineers in their problems in the design, construction and maintenance of overhead lines involving the use of Crapo steel conductors. The booklet "Sag and Tension Charts—Heavy Loading" is available from Indiana Steel & Wire Co., Muncie, Ind.

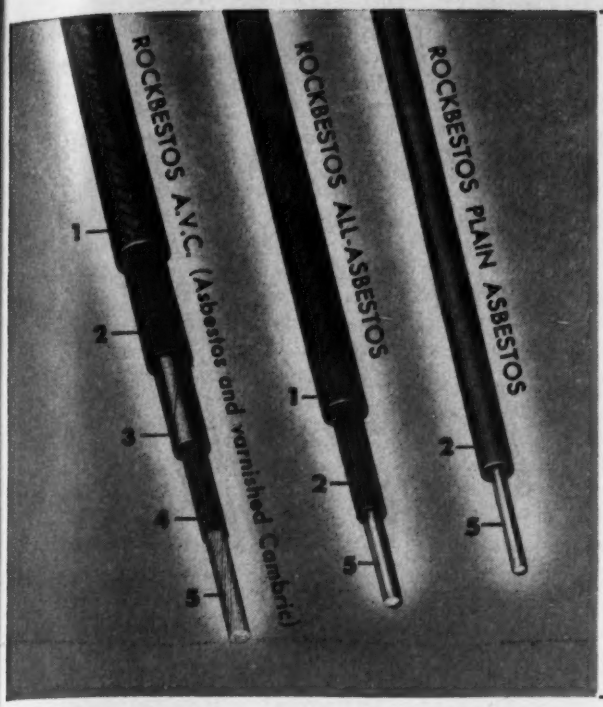
STANDARDS—"A.S.T.M. Standards on Electrical Insulating Materials," 1944 volume. American Society for Testing Materials, 260 South Broad St., Philadelphia 2, Pa.; price $2.75 per copy. This 515-page publication contains in their latest form the more than 75 A.S.T.M. standards specifications and test methods. New material includes requirements for phenolic molding compounds; laminated thermosetting materials; vulcanized fiber sheets, rods, and tubes; natural block mica; orange shellac and other lacs; pin-type line glass insulators, and tensile properties of plastics.

"CARE AND MAINTENANCE OF ELECTRICAL EQUIPMENT" is a convenient pocket-size booklet containing simple instructions for keeping switches, panelboards and switchboards in good operating condition. The 28-page maintenance booklet No. CA-564 can be obtained from Square D Co., 6060 Rivard St., Detroit 11, Mich.

HAZARDOUS CHEMICALS—"Table of Common Hazardous Chemicals," a booklet published by the National Fire Protection Association in co-operation with the American Chemical Society. Data are included on 98 chemicals with respect to their fire hazard, life hazard, storage, proper methods of fire fighting, and recommendations of suitable extinguishing agents for fires which cannot be fought with water. The "flash point," "explosive range" and "ignition temperature" are given for those chemicals where such information is essential. Copies may be obtained from the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass., for 30 cents each.

"NEW PRODUCTS CHECK CHART" has been developed around a list of 46 questions and provides a systematic plan whereby a manufacturer can quickly appraise a product which he believes might be a desirable one for his company to make. This chart, which also serves as an outline for a detailed study of the principal factors involved, is available from Designers For Industry, Inc., 2915 Detroit Ave., Cleveland 13, Ohio.

CLASSIFIED DIRECTORY 1944—A publication of the Association of Consulting Chemists and Chemical Engineers, Inc., contains 96 pages of membership information such as member scope sheets, alphabetical index, company affiliations, and geographical location. A copy may be had from the Association of Consulting Chemists and Chemical Engineers, Inc., 50 East 41st St., New York 17, N. Y.



3 GETS YOU 122

122 wires, cables and cords, stemming from the three basic designs illustrated, have been developed by Rockbestos to give trouble-free performance under severe operating conditions in steel mills, power plants, chemical industries, etc. Send for catalog to see the rest.

Rockbestos Permanent Insulation Insures Long-Lived Performance

1. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
2. Felted asbestos insulation impregnated with heat-, flame-, and moisture-resisting compounds will not dry out, become hard and brittle, or burn. Also serves as a heat-barrier against high ambient temperatures.
3. Lubricated varnished cambric for high-dielectric strength and added moisture resistance, protected from heat, flame, and oxidation by felted asbestos walls.
4. Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.
5. The conductor is perfectly centered in helically applied insulation and will always remain so.

600 VOLT A.V.C. SWITCHBOARD WIRE—TABLE B
(Underwriters' Type AVB)

Sizes No. 18 to 4/0 A. W. G. with varnished cambric and felted asbestos insulation and gray, black, white or colored flameproof cotton braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is absolutely fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A. V. C. Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.

INDUSTRIAL HEATING CABLE—TABLE LH

No. 19 A. W. G. nickel-chromium wire insulated with .040" of felted asbestos and covered with 4/64" waterproof lead sheath.

This pliable cable distributes a mild heat evenly over a large area. Prevents freezing of water pipes, wet pipe sprinkler systems, etc. Keeps conveyor pipes for fuel oil, soap, varnish, ink, chocolate, etc., at temperatures that insure steady flow.

ASBESTOS INSULATED MAGNET WIRE

Round, square and rectangular asbestos insulated conductors finished to meet varying winding conditions and coil treatment requirements.

Protect your motors against heat-induced breakdowns with class B windings of Rockbestos Heat-Resisting Magnet Wire. Leads of A. V. C. Motor Lead Cable will complete the failure-proofing.

ALL-ASBESTOS FLEXIBLE CORD—TABLE CA

Sizes No. 10 to 18 A. W. G. with two or three conductors insulated with felted asbestos, covered with asbestos braid. Also in A. V. C. (asbestos and varnished cambric) constructions.

This heat-resisting flexible cord is ideal for high-wattage lighting units, floodlights, blueprint machines, apparatus, etc., which require a heavy duty, enduring cord. For moisture-resistant construction specify the A. V. C. type. Labeled cord with polarized conductors if desired.

600 VOLT A.V.C. BOILER ROOM WIRE—TABLE C
(Underwriters' Type AVA)

Sizes No. 18 to 4/0 A. W. G. This construction for sizes 18 to 8, sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A. V. C. construction is ideal. Also for locomotive panel wiring and for switchboards requiring an asbestos braided wire.

THERMOSTAT CONTROL WIRE—TABLE TC

Sizes No. 14, 16 and 18 A. W. G. in two to six conductors with 12½, 25 or 31 mil wall of felted asbestos insulation and cadmium plated steel armor.

A multi-conductor control wire for low voltage intercommunicating, signal and temperature control systems. Its lifetime insulation and rugged steel armor will give you trouble-proof circuits.

600 VOLT ALL-ASBESTOS RHEOSTAT CABLE—TABLE R
(Underwriters' Type AI)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this power and rheostat cable for wiring rheostats, switchboards, elevator and locomotive control panels and electrical equipment exposed to heat, fumes and fire hazard. Also for general open wiring in dry, high temperature locations. For solid conductor specify Rockbestos Rheostat Wire, Table A.

600 VOLT A.V.C. MOTOR LEAD CABLE—TABLE L
(Underwriters' Type AVA)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with two walls of felted asbestos and a high-dielectric, heat-sealed varnished cambric insert, covered with heavy asbestos braid.

Heatproof, fireproof, greaseproof and oilproof, will not dry out and crack, won't burn or carry flame, and remains permanently flexible. For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, etc.

600 VOLT A.V.C. CONTROL CABLE

In one to 19 conductors. Standard stranding A. W. G. No. 12—19/No. 25 and No. 9—19/No. 22. Other strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

600 VOLT A.V.C. POWER CABLE—TABLE E
(Underwriters' Type AVA)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with laminated felted asbestos, varnished cambric, and asbestos braid. Other constructions for service voltages to 8000.

Recommended for power circuits and hot spot wiring in or around boiler rooms, steam tunnels, soaking pits, tenter frames, glass plants, etc. The asbestos and heat-sealed varnished cambric construction has ample moisture resistance and withstands high temperatures.

Rockbestos Products Corporation, 938 Nicoll Street, New Haven, Conn.

WON'T bake brittle, bloom, burn or rot—RESISTS heat, moisture, oil, grease and fumes

ROCKBESTOS

The Wire with Permanent Insulation

NEWS ABOUT PEOPLE

Directs Pennsylvania Transformer Sales

Announcement has been made by the Pennsylvania Transformer Co. of the appointment of W. R. Swoish as sales manager of the company.

A graduate of Ohio State University

W. R. Swoish

in electrical engineering, Mr. Swoish has had wide experience in the electrical industry. He was sales manager of both the distribution transformer section and the switchgear division at Westinghouse. Mr. Swoish was affiliated with the Roller-Smith Co. as sales manager from 1939 to 1943. He spent a short time in the Cleveland office of Allis-Chalmers before joining the Pennsylvania Transformer Co. His new headquarters will be at the company's main offices in Pittsburgh.

•

► KENNETH S. M. DAVIDSON, associate professor of mechanical engineering and director of the experimental towing tank laboratory, Stevens Institute of Technology, Hoboken, N. J., has been appointed professor of mechanical engineering. A graduate of M.I.T., he served in World War I and then was engaged in the design and development of heavy machinery. Other industrial connections have been with the Sullivan Machinery Co. and the Crosby Steam Gage & Valve Co. WILLIAM L. SULLIVAN has been appointed associate professor of electrical engineering and director of the graduate school. Also a graduate of M.I.T., Mr. Sullivan joined the staff at Stevens as an instructor in 1934, has been an assistant professor since 1936 and assistant to the dean of the graduate school since 1939.

► EUGENE J. SHAPIRO has been elected secretary of the Union Electric Co. of Missouri and its subsidiary companies. He succeeds Frank J. Meistrell, who resigned last month to re-enter law practice in the East. Mr. Shapiro is a graduate of Washington University, St. Louis, and has been with the company since 1926. He had served as assistant secretary since March, 1941.

•

Marshall Made Executive of Pacific Electric

William R. Marshall, prominent Pacific Coast electrical figure, was recently appointed executive vice-president of Pacific Electric Manufacturing Corp., of San Francisco. Mr. Marshall began his career at Westinghouse Machine Co. in 1909 after obtaining a degree in mechanical engineering from North Carolina State College. In 1914 he joined the power department of Westinghouse Electric & Manufacturing Co. and was successively industrial manager of the New York office in 1920,

district manager of the Buffalo office in 1921, and district manager of the Pittsburgh office in 1925.

In 1928 he organized the Pacific Coast district of Westinghouse of which he was manager, and in 1933 he was made vice-president in charge of that district.

Mr. Marshall resigned from Westinghouse in 1940 to establish his own business, and was recently associated with the Moore Machinery Co. of San Francisco. Mr. Marshall also has been a director of the Pacific Coast Electrical Association.

•

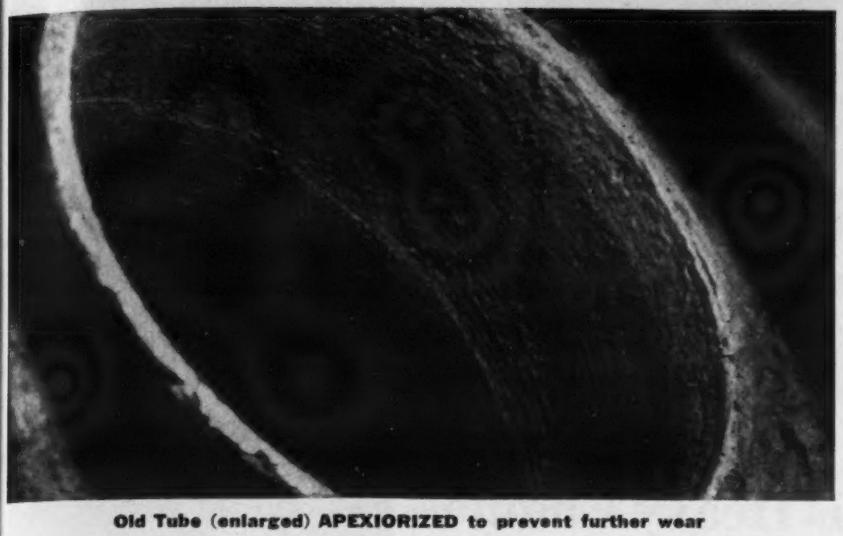
Lobban Assumes Broader Duties in Detroit

James H. Lobban, assistant secretary of Detroit Edison Co., has been appointed general accountant of the company. Mr. Lobban joined the Detroit utility in 1911 as an engineer in the statistical department. In 1913 he was

appointed property engineer; in 1918 assistant general accountant; and in 1935 assistant secretary of the company. He is a graduate of the University of Michigan in electrical engineering and has acquired his accounting knowledge through experience and special courses of study.

Since 1915 Mr. Lobban has been active in the electric utility accounting field. He was a member of the classification of accounts committee of the former National Electric Light Association, which worked jointly with the National Association of Railroad and Utilities Commissioners to obtain a standard system of accounts for the electrical industry throughout the United States. Subsequently he was first chairman of the fixed capital records committee of the N.E.L.A. In 1933 he became chairman of the accounting committee of the Edison Electric Institute. Lobban was also a mem-

How Much Longer Will Your Boilers Stand Up?



Old Tube (enlarged) APEXIORIZED to prevent further wear

Send for bulletin 1290 which gives the facts on a paint that gives new life to metal.

Users like these have Apexiorized their equipment. Try it on yours.

Utah Copper Company
Westinghouse Electric & Mfg. Co.
Moore-McCormack Lines
Florida Public Service Company
The Pusey & Jones Corporation
Wilson & Company, Inc.
Bethlehem Steel Company
Scovill Manufacturing Company
E. I. duPont de Nemours & Company
Chicago-Bridge & Iron Company
Pratt & Whitney Aircraft Co.
Wright Aeronautical Corporation

In these days of supercolossal war schedules, do you ever worry about the condition of your plant boilers? Do you wonder what you can do to prolong their life until the time when scarce metal becomes plentiful once more?

Many maintenance engineers have found the answers to these questions in APEXIOR . . . a special protective coating purposely made for boiler and turbine metal.

They have used APEXIOR on new equipment as well as on old equipment . . . on new equipment to insure against premature old age, on old equipment to prolong its useful service. They have, in some cases, been able to salvage discarded boilers that seemed to have outlived their usefulness by cleaning them and then coating them with APEXIOR.

APEXIOR PREVENTS CORROSION FOR 2-3 YEARS

APEXIOR is brush-applied, by hand or power coater. It seeps into the metal pores and joints and forms an impenetrable barrier against water. There is less adherent scale, so scale removal is required less often . . . and when it is necessary, the job can be done easily with a wire brush.

Painting boiler metal with APEXIOR is recommended by boiler insurance companies. And many turbine manufacturers coat shafts, rotor bodies, and, frequently, interiors of casings with APEXIOR before shipping to customers.

APEXIOR is the safe, sure answer to . . . how can boiler life be extended? It will save your boiler metal from the ravages of rust that can not be measured in dollars today. Get the facts today.

APEXIOR

A Peacetime Plus ★ ★ ★ A Wartime Must

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

The **DAMPNEY COMPANY of America**
protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park 36, Mass.

Please send free Bulletin 1290 (Industrial) ☐
1305 (Marine) ☐

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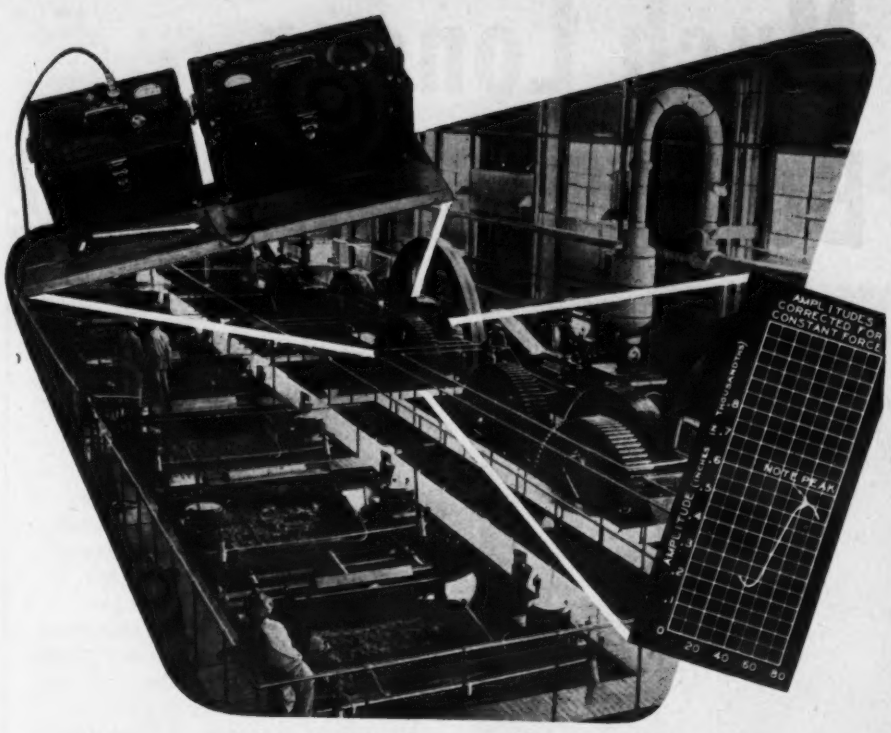
Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Honolulu, T. H., Marine Dept., 114 Liberty Street, New York City, N. Y.



VIBRATION in this Heavy Engine Foundation Located and Analyzed

with General Radio Vibration Meters

VIBRATION in this sugar-cane grinding tandem in the Florida Everglades was sufficiently serious to cause uneven settling of the heavy concrete foundation. The magnitude of the vibration depended upon the speed of one of the three Corliss engines driving the tandem, increasing as the speed increased.

MEASUREMENTS with the General Radio Vibration Meter and Analyzer showed that the frequency of the main component of the vibration corresponded to the single-mesh frequency of the main pinion on the engine. A speed-vibration characteristic, taken over the complete range of operating speeds, showed a pronounced resonance peak at 68 rpm, near top speed. Calculations confirmed the fact that the concrete foundation was in resonance at the gear mesh frequency corresponding to this speed.

ELIMINATION of the vibration was simple, once its nature and source were completely known. The cause was found to be poor gear alignment, resulting in worn gear teeth.

Most vibration problems encountered in industry are simple—when you know the answer. General Radio noise and vibration-measuring instruments are designed to get that answer for you quickly and accurately. Their theory and operation is completely described in "The Noise Primer." Write for your copy today.

Ask for Bulletin No. 872

Because all of our facilities are devoted to war projects, this equipment is at present available only for war work.

ARMY E NAVY

GENERAL RADIO COMPANY

Cambridge 39, Massachusetts

NEW YORK CHICAGO LOS ANGELES

ber of the E.E.I. depreciation committee and has been a member of the accounting executive committee of the E.E.I. from 1933 to date.

•

A. H. Manwaring Assigned New Executive Duties

A. H. Manwaring has been elected executive vice-president of the Philadelphia Electrical & Manufacturing Co., Philadelphia, Pa.

Mr. Manwaring was graduated from Pennsylvania State College in 1934 and served as a cadet engineer with the Philadelphia Electric Co., from that time to 1936, when he entered the utility's industrial sales department. It was in 1938 that he became associated with the Philadelphia Electrical & Manufacturing Co. in the capacity of manager of commercial sales. In 1940 Mr. Manwaring was made manager of the sales and engineering departments.

•

► J. L. PHILLIPS has recently joined the engineering staff of J. M. Clayton Co., contracting electrical engineers, Atlanta, Ga. Mr. Phillips is a graduate of the Georgia School of Technology, was formerly associated with the Georgia Power Co., Atlanta; Allied Engineers, Inc.; Alabama Power Co. and the Rust Engineering Co. of Birmingham. He has recently served as project manager for Juneman Electric Co., in charge of the construction of the complete electrical system for the Huntsville Arsenal and Redstone Ordnance Plant, Huntsville, Ala.

► THOMAS H. WAGNER has been appointed assistant to the president of Eureka Vacuum Cleaner Co., Detroit, Mich. Mr. Wagner joined Eureka in 1940 as sales statistician, and when the company completed total conversion to war work early in 1942, he was trans-

Details of

HEAVY TIMBER CONSTRUCTION

for mills and factories

Published by the National Lumber Manufacturers Association

HEAVY TIMBER CONSTRUCTION DETAILS
WOOD UTILIZATION DATA
PLANK NO. 1
ROOF BEAM
FLOOR BEAM
ROOF GIRDER
FLOOR GIRDER
HEAVY TIMBER CONSTRUCTION
PLANK FLOOR, BEAM & GIRDER TYPE
BEAM-ON-GIRDER FRAMING IS SHOWN ABOVE, AND IN DETAILS "J" & "K". PLATE NO.
CLEAR CEILING HEIGHT IS PROVIDED BY BEAM-INTO-GIRDER FRAMING, DETAILS "L" & "M".
HEAVY TIMBER CONSTRUCTION DETAILS
WOOD UTILIZATION DATA
PLANK NO. 4
ROOF PLANKING
PURLIN
TRUSS
FLAT TRUSS - TWO PIECE SPACED MEMBERS
PURLIN SHOE BOLTED TO WALL OR TO A FLOOR BEAM BELOW

FREE
TO ARCHITECTS AND ENGINEERS

SHOWS DETAILS OF:

- Plank floor and beam type
- Laminated floor and beam type
- Plank floor, beam and girder type
- Truss and purlin roof framing
- Floor beam and column connections
- Roof beam and column connections
- Floor framing at exterior walls
- Roof framing at exterior walls
- Beam and girder framing
- Roof framing at party walls

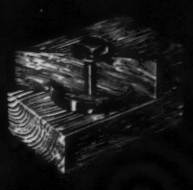
Profusely illustrated with detailed drawings and other useful information. For a complimentary copy, write, using your firm letterhead, to The Timber Engineering Company, Washington, D. C., and Portland, Oregon.

For Modern Timber Construction *Specify* **TECO** Timber Connectors and Tools

TIMBER ENGINEERING COMPANY

NATIONAL MANUFACTURERS OF **TECO** TIMBER CONNECTORS AND TOOLS

WASHINGTON CHICAGO MINNEAPOLIS NEW ORLEANS PORTLAND



The **TECO** *Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood, brings the full structural strength of lumber into play.*

...when you bend pipe with a GREENLEE

TIME-SAVING TOOLS FOR ELECTRICAL WORK

BENDERS. Complete line of powerful hydraulic and hand benders for every bending job; pipe up to 4½"; rigid and thin-wall conduit; steel, brass and copper tubing; bus-bars.

CABLE PULLERS. Makes the tough job of cable pulling easy. Pulls cable into exposed or concealed conduit in half the time required with cumbersome equipment. Easily carried, operated by one man.

JOIST BORERS. The convenient, work-saving way to bore holes in joists for knob-and-tube wiring and for conduit. Ball bearing operation. Easily assembled.

KNOCKOUT TOOLS. Greenlee Knockout Punches and Knockout Cutters save hours of work in cutting smooth accurate holes. Enlarge holes without drilling, reaming or filing.

RADIO CHASSIS PUNCHES. A special Greenlee tool for cutting holes in radio chassis for sockets, plugs and other receptacles. Cuts or enlarges holes in a jiffy. A big time saver for the radio worker.

PIPE PUSHERS. One man easily pushes pipe through ground by powerful hydraulic action. Eliminates extensive trenching, tearing up lawns and pavement in installing pipe.

The Greenlee Hydraulic Bender above has been in use fourteen years at Squire Electric Co., Kansas City, Mo. C. F. Miles, General Superintendent, finds it cuts their labor hours in two on bending jobs. And he tells us it's especially valuable when uniform bends of the same radius are required.

Ask leading electrical contractors everywhere and you'll find Greenlee Benders the leaders in the field. Speed, accuracy, easy operation, portability and fast set-up . . . all make for important savings in time and materials. Smooth, accurate, uniform bends are produced in less time, with no kinks or serious damage to conduit finishes.

The well-equipped contractor knows good tools are essential to modern electrical installation work. And it's a vital matter under today's critical man-power conditions.

WRITE FOR FREE BENDER BOOKLET S-116
So get the facts now on Greenlee's complete line of hydraulic and hand benders for every bending job. Write for Bender Booklet S-116, also Catalog 33-E on Greenlee time-saving tools for electrical work. Greenlee Tool Co., 1804 Columbia Ave., Rockford, Ill.

Get Ready with Greenlee!

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN

ferred to the factory manager's staff to assist in budget preparation, procedure and control. In his new position, Mr. Wagner will work on such assignments as post-war planning, war contract terminations, and special activities on current war work.

•

E. Schleusener Directs Operations for Oliver

At the organization meeting of the board of directors of Oliver Iron & Steel Corp., Ernest Schleusener was

elected vice-president in charge of operations, and John P. Roche was elected secretary and assistant to the president.

Mr. Schleusener received his bachelor of science degree in mechanical engineering at Carnegie Tech. Since he joined Oliver he has served in various executive capacities in the plant. Since May, 1942, he has been assistant vice-president in direct charge of engineering and production control. During 1943 he put into operation the shell plant of the Oliver Iron and Steel Corp., manufacturing 37 and 75mm armor piercing shot.

Mr. Roche was recently named Pennsylvania's outstanding "Man of the Year," by the United States Junior Chamber of Commerce. He is a graduate of Duquesne University and the University of Pittsburgh Law School. Mr. Roche is an industry member of the Regional War Labor Board.

•

► WILLIAM E. MILLER has been appointed general attorney of the Westinghouse Electric & Manufacturing Co. in charge of the company's law and patent department. Mr. Miller's headquarters remain in Pittsburgh, Pa., where he has been in charge of the Pittsburgh office of the Westinghouse law department. A member of the

WHEN YOU CHECK UP ON YOUR PLANT'S PAY-ROLL SAVINGS PLAN FIGURES!

These days, things change with astonishing speed. The Pay-Roll Savings Plan set-up that appeared to be an outstanding job a short time ago, may be less than satisfactory today.

How about checking up on the situation in *your* plant? Checking up to see if everybody is playing his, or her, part to the full measure of his, or her, ability. Checking up to see if 'multiple-salary-families' are setting correspondingly multiple-savings records.

A number of other groups may need attention. For example, workers who have come in since your plant's last concerted bond effort. Or, those who have been advanced in position and pay, but who may not have advanced their bond buying accordingly. Or even those few who have never taken part in the plan at all. A little planned selling may step contributions up materially.

But your job isn't finished, even when you've jacked participation in your Pay-Roll Savings Plan up to the very top. You've still got a job before you—and a big one! It's the task of educating your workers to the necessity of not only buying bonds, but of *holding* them. Of teaching your people that a bond sold before full maturity is a bond robbed of its chance to return its full value to its owner—or to his country!

So won't you start *checking* . . . and *teaching* . . . today?

War Bonds To Have And To Hold!

LET'S ALL BACK THE ATTACK WITH WAR BONDS!

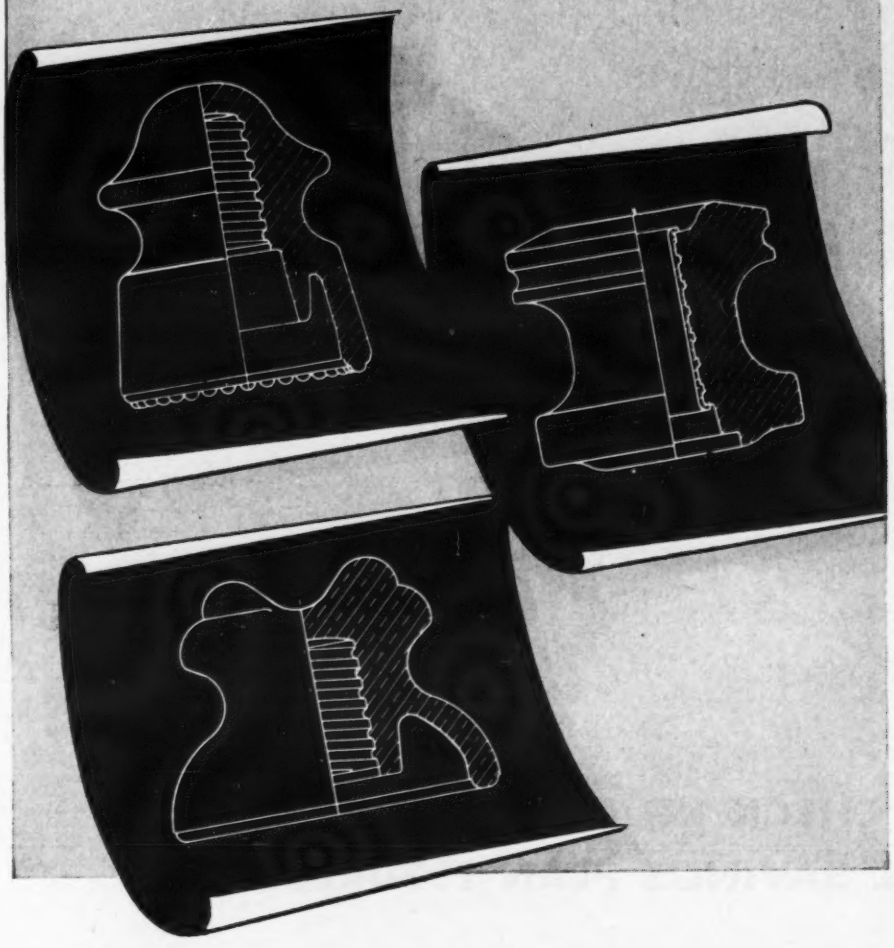
The Treasury Department acknowledges with appreciation the publication of this message by

ELECTRICAL WORLD

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council

HEMINGRAY INSULATORS

Favorably Known Since 1870



Power Insulators You Can Rely Upon!

Hemingray Insulators are always dependable.

The reason? *They're precision-built—under exacting quality production control.*

Every step in the manufacturing process is checked and rechecked—all along the line.

That's your assurance of *uniform quality* and *dependability.*

Investigate! There are 10 Hemingray Insulators for Primary Power Distribution and 10 Hemingray Insulators, Knobs and Spools for Secondary Power Distribution.

Hemingrays are sold by principal jobbers and are manufactured by Owens-Illinois, Hemingray Division, Muncie, Ind.

OWENS-ILLINOIS

HEMINGRAY INSULATORS

Telephone-Telegraph

Export Agents: International Standard Electric Corporation, New York City

company's legal staff for 29 years, Mr. Miller in 1942 was awarded the Order of Merit for "his broad knowledge of the company's activities and of the law relating thereto; his skill and diplomacy and general executive ability."

► GEORGE A. DUSENBURY has been appointed assistant manager of the advertising and public relations department of the Allis-Chalmers Manufacturing Co., Milwaukee. Mr. Dusenbury goes to Allis-Chalmers from the company's agency, the Compton advertising organization. He obtained his education at the University of Michigan and his advertising experience in the automotive and general agency fields.

•

U. S. Rubber Announces Eight Staff Promotions

Eight members of the Bristol plant, U. S. Rubber Co., have received promotions, according to announcement by W. A. Armstrong, factory manager of the Rhode Island plant.

W. K. Priestley, formerly chief of process engineering, has been promoted to the position of development engineer; L. E. Dickinson, chief chemist to chief process engineer; W. H. Dibble, assistant chief chemist to chief chemist and J. F. S. Abbott to chief latex engineer in charge of latex development and control.

Other appointments include: F. S. Bartlett to assistant factory manager; T. C. Jannsen to production manager in charge of planning and manufacturing; A. E. Newton to general foreman of manufacturing departments and J. Waters to foreman of latex towers.

•

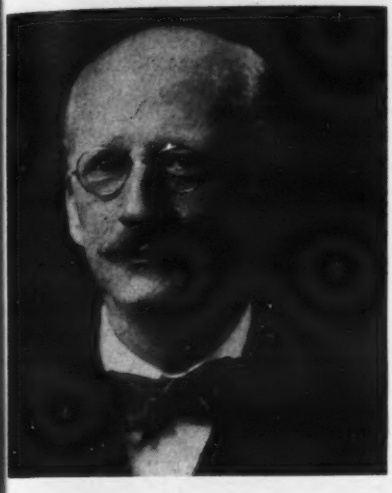
► PHILIP L. THOMSON, director of public relations of the Western Electric Co., has retired, effective April 1, after 41 years of service. He will be succeeded by FRED B. WRIGHT, an executive of the company's distributing organization. Mr. Thomson joined Western Electric as a voucher clerk in 1903 after receiving degrees from Union College and Harvard. He rose through the ranks, becoming manager of the company's distributing house at Pittsburgh in 1905, and, in 1911, advertising manager at New York headquarters. In this capacity, he directed all of the company's public relations activities, a responsibility he continued to discharge during the ensuing 33 years. Since 1927 Mr. Thomson has been president of the Audit Bureau of Circulation, the organization devoted to the self-regulation of the publishing and advertising business. He was president of the Association of National

Advertisers in 1923 and 1924 and was also active in the affairs of the Advertising Federation of America. Mr. Wright takes up his new responsibility with a broad background in the field of distribution and sales. He has been identified with Western Electric since 1922.

OBITUARY

George A. Orrok

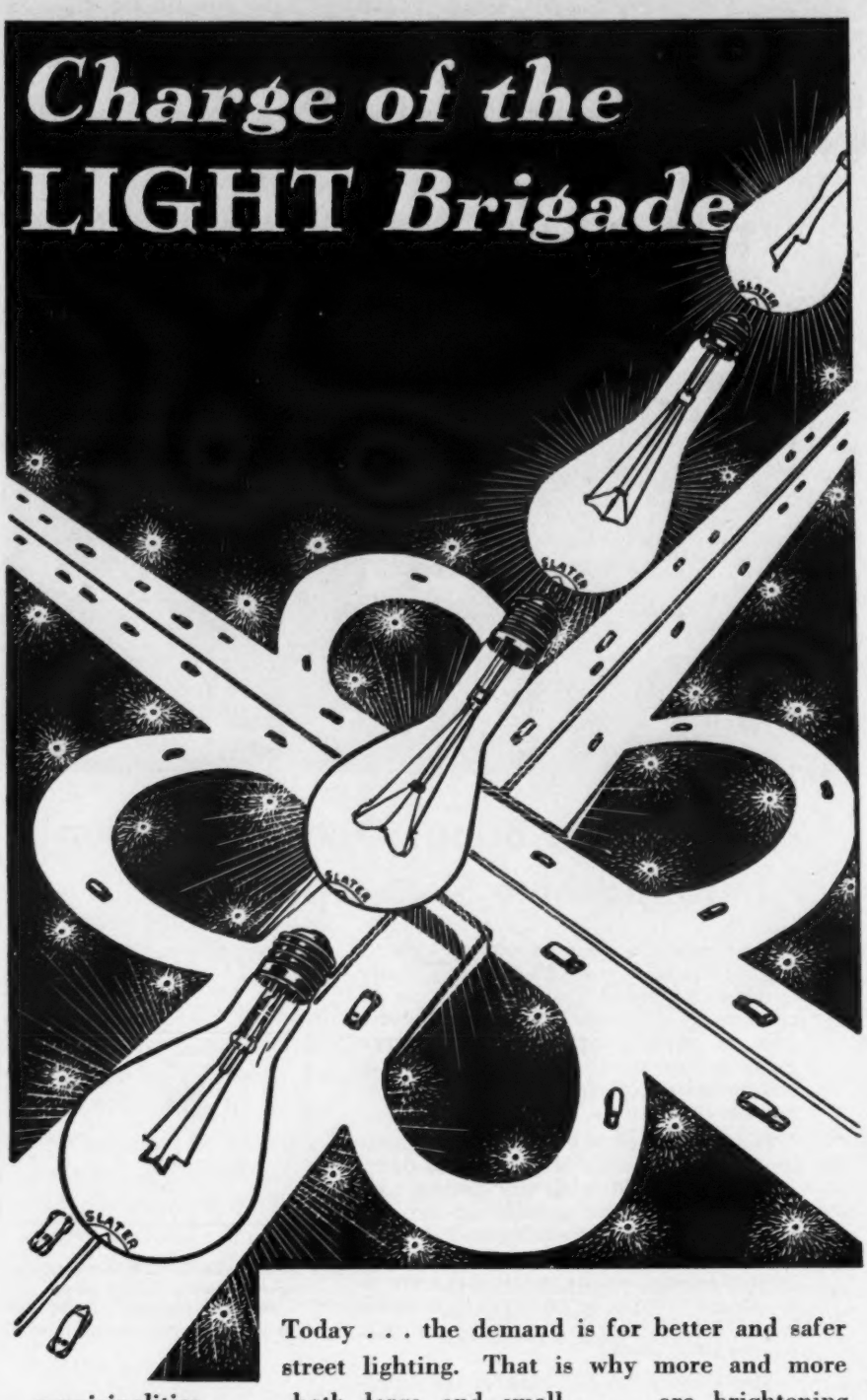
George A. Orrok, for many years consulting engineer for the New York Edison Co., and widely known as an authority on power plant engineering, died on April 6 at his home in Riverside,



Conn. He was 77 years old. Mr. Orrok had been associated since 1931 with David M. Myers and W. A. Shoudy in consulting practice with offices in New York. Joining the New York Edison Co. in 1898 as mechanical engineer, he served in that capacity until 1914, when he became consulting engineer, the position he held for the next fourteen years. During this time he worked on the design of many of the large power stations of the company. From 1898 to 1914 he also served as assistant engineer with Thomas E. Murray and in that capacity did considerable work for the Brady interests. Among the plants on which he worked were Dayton, Ohio; Riverside plant at Albany, N. Y.; Trenton Falls hydro plant of the Utica Gas & Electric Co.; the Hales Bar hydro-electric plant, Tennessee, and the Sherman Creek, Hell Gate, Hudson Avenue and Waterside 1 and 2 of the New York Edison Co.

Mr. Orrok was an early investigator of heat transfer in surface condensers and was an authority on heat transfer between steam and water.

Born in Dorchester, Mass., he attended the Massachusetts Institute of Technology and the Stevens Institute of Technology, and taught steam engineer-



Today . . . the demand is for better and safer street lighting. That is why more and more municipalities . . . both large and small . . . are brightening their important traffic arteries. And SLATER Lamps are playing their part in this charge of the "Light" brigade. For SLATER Lamps are built to provide *more light* and *life*, at low cost, wherever adequate night visibility is needed. There are many reasons why SLATER Lamps are gaining wider acceptance, explained in our new catalogue, yours for the asking.

SLATER ELECTRIC & MFG. CO.

BROOKLYN, NEW YORK

MANUFACTURERS OF STREET LIGHTING LAMPS, AND PRECISION ELECTRONIC TUBES

SLATER

Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.

Center Scope Brings Optical Precision to Machine Shop Operations

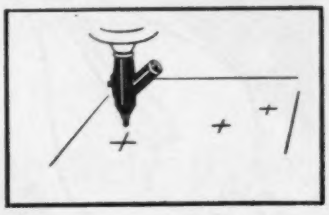
The Center Scope is an optical centering and locating tool that can be easily and quickly used on any machine to center work reference lines to a spindle axis. It permits accuracy to a degree never before obtainable, as the optical beam or line of sight is absolutely inflexible and cannot be distorted.

The Center Scope's easy accuracy eliminates many human errors, as the operator can see just what the cutting tool will do before it is actually fed into the work. It increases production, improves efficiency and prevents spoilage. There is no pressure on the work piece nor is it subject to wear or changes in temperature—for the Center Scope never touches the layout.

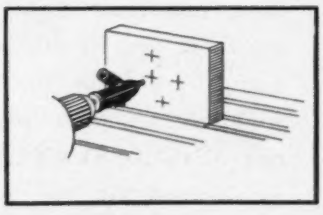
The Center Scope enables the operator to easily and quickly locate edges to a spindle axis, set-up faster and compensate for run-out. It saves vital hours in checking, inspecting and measuring when mechanical methods and tools are impossible to use. Its 45 x magnification allows operator to see ".001" and requires no technical knowledge or training to operate.

While there is nothing particularly new or ingenious about Wrigley's Spearmint gum, it is proving useful to millions of people in many new ways. Workers in war plants everywhere have found it helps keep them alert and relieves nervous tension and dry mouth while they are on the job.

You can get complete information from the Center Scope Instrument Company, 351 S. LaBrea Ave., Los Angeles, California, or Kearney & Trecker Products Corporation, Milwaukee, Wisconsin.



ON A VERTICAL MILL—locating and centering height gauge or size block layouts. Permits jig borer accuracy on more machines.



ON A HORIZONTAL MILL—the ability to center a layout, edge block or rotary table plug while spindle is running. Permits quick and easy set-up for high precision work.

Y-111

ing from 1911 to 1914 at the Brooklyn Polytechnic Institute, and was on the faculty of Yale, Harvard and Princeton Universities as a lecturer.

In the course of his distinguished career, Mr. Orrok addressed many engineering groups on electrical subjects and was the author of several articles published in the ELECTRICAL WORLD.

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▶ HOWARD F. VIOT, manager of G. E. lamp department's Midwest sales district, died of a heart attack on March 28 in Kansas City. He was 56 years of age. Mr. Viot joined General Electric in 1907 as a salesman for the Shelby (Ohio) Lamp Co. In 1926, he was appointed manager of G. E. lamp division's southwestern district at Kansas City. The name of that territory, covering a wide area of the middle western section of the country, was later changed to Midwest Sales District. He was widely known throughout this territory. Mr. Viot served as president and director of the Kansas City Electric Association and was chairman last year of the local I. E. S. chapter.

▶ JOHN H. FISHER, director of the Southern California Edison Co. and prominent Southern California industrial leader, died March 21 in Pasadena. Son of Henry Fisher, one of the founders of the Redlands Electric Light & Power Co. whose Mill Creek No. 1 plant was the first three phase hydro-electric plant in the United States, Mr. Fisher was an active member of the western electrical industry. He had been a member of the board of directors of Southern California Edison for 34 years, and was president of electric railways in San Bernardino and Redlands.

▶ WYCLIFFE C. MARSHALL, 55, for many years prominent as an attorney seeking rate reductions before the Massachusetts Department of Public Utilities, died suddenly at Watertown, Mass., on March 26. He was born at Marlboro, Mass., and was educated at Northeastern Law School. Of late Mr. Marshall had been engaged in war material production in a Boston industrial plant.

▶ LEROY J. HANNAH, about 60 years of age, in recent years connected with the automobile business, but formerly connected with the utility industry, died of a heart attack at the Henry Clay Hotel, Louisville, on February 13. Mr. Hannah went to Louisville in 1906 with the Tennis Co., builders of the Louisville-Indianapolis traction line. When the line was completed in 1908 he joined the Kentucky Electric Co., as department superintendent, and after

the merger of that company with the Louisville Gas & Electric Co., he became first manager of its commercial department in 1913. A year later he left the utility field and subsequently became identified with the automibile industry.

▶ GEORGE F. ELLIOTT, 70, for 55 years with the Walworth Co. and manager of its Boston offices, died at Brookline, Mass., on March 26. He was regarded as the dean of the regional industry in the field of power plant piping and accessories.

▶ CHARLES L. TAYLOR, 68, former head of the Farmington River Power Co., Springfield, Mass., and at one time a director of the Terry Steam Turbine Co., Hartford, Conn., and Landers, Frary & Clark, New Britain, Conn., died at Hartford, on March 30. He was prominent for many years in the machinery building and foundry fields of Connecticut.

▶ CLYDE D. GRAY, formerly chief engineer and head of the electrical department of the J. G. White Engineering Corp., New York, died on March 29 in the New Rochelle Hospital, near his home in Pelham, N. Y., after an illness of several years. He was 67 years of age. Mr. Gray was identified with the J. G. White organization from 1901, the year in which he was graduated from Cornell University, until 1940 when he retired. He was a fellow of the American Institute of Electrical Engineers and a member and former vice-president of the New York Engineering Society.

▶ HUGH W. SPAULDING, secretary of Handy & Harman, New York, died on March 31. Mr. Spaulding had been identified with the domestic and foreign operations of Handy & Harman for many years. Starting in 1902. Mr. Spaulding rose in the company through the bookkeeping, accounting, and sales departments. He was appointed cashier in 1919 and elected secretary in 1924.

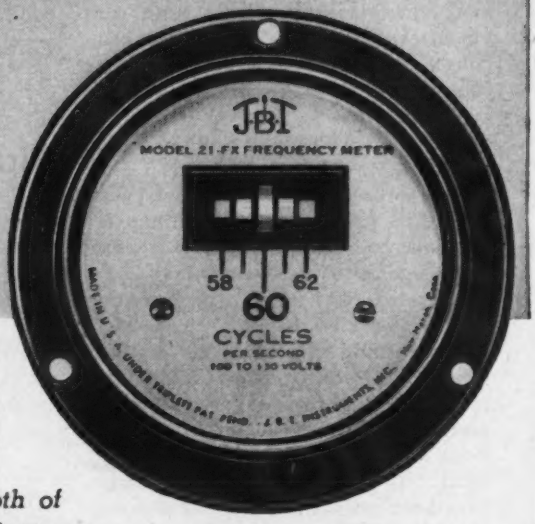
▶ EDWIN W. CREED, 75, for 25 years an electrical engineer with the Armstrong Cork Co., South Braintree, Mass., until his retirement in 1940, died in that place on March 28.

▶ HARRY G. WOOD, consulting electrical engineer for the Worthington Pump & Machinery Corp., Harrison, N. J., died on April 4 at Lawrence Hospital in Bronxville, N. Y. He was 52 years old. Following graduation from the University of Illinois, Mr. Wood joined Westinghouse. He served in World War I and then resumed his work with Westinghouse where he remained until 1930 when he became identified with the Worthington company.

A True Miniature

A NEW J-B-T VIBRATING REED FREQUENCY METER WITH DEPTH TO MATCH YOUR OTHER 2½" INSTRUMENTS!

ACTUAL SIZE



These new J-B-T Vibrating Reed Frequency Meters meet the requirements of ASA C39.2 – 1944 for Electrical Indicating Instruments, in *depth of case* as well as in mounting dimensions and mounting hardware.

Now, for the first time, it is possible to have uniformity in all electrical instruments on the panel, simplifying design and assembly. They are appreciably *lighter*, too, but still retain all of the advantages of the vibrating reed construction.

For these compact new meters for 60 cycles, 120 cycles and 400 cycles give full size performance. They are permanently accurate and require no adjustment while in service. Their accuracy is not affected by wave form, normal temperature change, voltage fluctuations or external magnetic fields, and they are easy to read – Simply Read the Reed, and That's Your Frequency.

MODEL 21-FX

Flange diameter, 2 1/16". Black molded case for flush panel mounting – single window type – 3 to 5 reeds. Half or full-cycle increments at 60 cycles – proportional increments for other frequencies. Accuracy, under normal operating temperatures, ±0.3% on full cycle increments. Frequency combinations down to 40 cycles or up to 550 cycles per second. No external reactor.

Illustrated booklet on the complete J-B-T line of vibrating reed frequency meters gives technical data. Ask for Bulletin VF-43, including supplemental VF-43-1B.

J-B-T

(Manufactured under Triplett Patents and/or Patents Pending)

J-B-T INSTRUMENTS, INC.

439 CHAPEL STREET • NEW HAVEN 8, CONNECTICUT

MANUFACTURING-MARKETS

Allis-Chalmers Earns All-Time High

Allis-Chalmers Manufacturing Co. was able to earn an all-time high in 1943, after all charges, according to the annual report recently issued. With sales for the year at $295,996,434, the company's earnings were $8,006,368 or the equivalent of $4.51 a share on outstanding common stock. In 1942, sales were $196,040,341 with a profit of $5,923,992, equivalent to $3.34.

In reporting to the stockholders, Walter Geist, president, said: "Since the beginning the company has recognized that winning the war comes first and it has devoted 100 percent of its resources toward that final result.

"Concerning new and better products for the 'world of tomorrow,'" Mr. Geist continued, "the company has many important items ready for instant development once its war obligations are fulfilled. As far as possible, sales outlets have been maintained and the company is in a favorable position to change back from wartime to peacetime production with a minimum of readjustment difficulties."

That civilian production will not get underway immediately is indicated by the order backlog. As of Dec. 31, 1943, the backlog totaled $335,926,644, or more than the total sales billed as a result of the record activity in Allis-Chalmers' nine plants all of last year. At the close of 1942, the backlog was $170,432,848, and, in comparison, $19,730,594 at the close of 1939 when the defense program was just beginning to be felt.

Last year also saw an increase in the orders booked, with a total of $461,490,229, compared with $241,461,632 in 1942, and $83,658,734 in 1939, the beginning of the rise due to the rearmament program.

•

Army-Navy "E" Awards

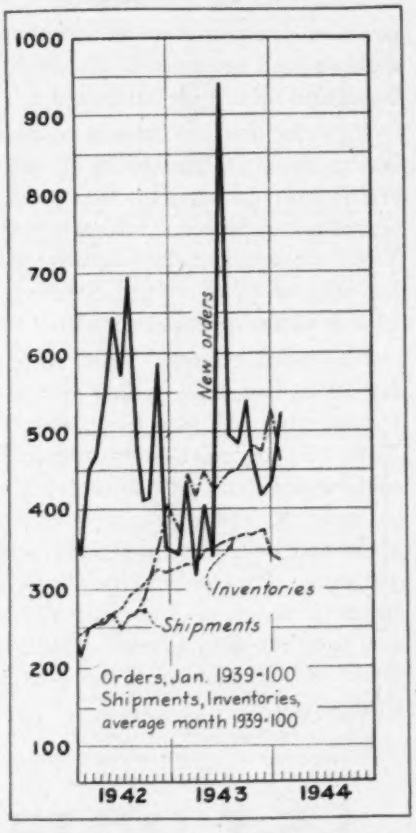
Two women war-workers, a Gold Star mother and another whose five sons are in the armed forces, were specially honored at a colorful ceremony on April 8 when the Army-Navy "E" award for outstanding war production was presented to the Shelby plant of the Anaconda Wire & Cable Co. A similar ceremony was held the same day at the company's Muskegon plant which also has been awarded the Flag of Excellence.

Another recent recipient of the "E" award was the Brewer-Titchener Corp., Cortland, N. Y., forging division.

•

Machinery Orders Rise in January

New orders received by manufacturers of electrical machinery advanced sharply in the month of January, 1944, the index compiled by the Bureau of Foreign and Domestic Commerce rising to 525 from 439 (revised) for the month of December, 1943. This compares with 346 for January, 1943.



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

The index covering electrical machinery shipments and inventories both declined in the month of January, according to the figures released by the Bureau. The shipments index dropped to 465 in January from 531 (revised) in December, comparing with 369 in January, 1943. The index covering inventories showed a much lesser decline than that covering shipments — from 346.0 in December (revised) to 338.1 in January, 1944. This compares with 327.0 in January, 1943.

•

G.E. Announces New Electronic Tube

A new electronic tube, which has made possible the development of a large new group of ultra-high frequency tubes using parts of the frequency spectrum impractical of use before the war, has been developed by General Electric Co.

A disk-seal type, the tube now is being widely used in war applications. After the war it will make possible radio relaying of television and frequency modulation radio programs, it was stated.

James D. McLean, the company's commercial engineer who described the new tube, predicted that within five years after the war there will be 100 active television stations serving 67,000,000 persons throughout the country.

A. A. Brandt, general sales manager of the electronic department, said that from the present indications it appears possible to produce television receivers post-war with excellent performance at prices around the $200 bracket, based on prewar levels.

The company has just instituted a reservation plan for the purchase of post-war television broadcasting equipment which it was said will help prepare for an orderly transition from wartime to peacetime manufacture.

•

G.E. Fluorescent Patents Upheld by Court

General Electric Co.'s fluorescent and germicidal lamp patents were upheld by Federal Judge Vincent L. Leibell who ruled last week that the patents had been infringed by the Hygrade Sylvania Corp. of New York, and the Raytheon Manufacturing Co. of Newton, Mass. The court dismissed a counter action by the defendants.

The court ruled, however, that no injunction relief would be granted to General Electric at this time because the government in an anti-trust suit ending in the New Jersey Federal Court charges

SOLID SHANK
The Strongest Known Spoon
• Solid shank construction, originated by True Temper, is universally acclaimed by all important shovel users—railroads, mills, mines—as first in service life, utility and efficiency.
The Sturdee Solid Shank Spoon is forged in one piece from a solid bar of steel—blade, shank and socket are all one—no seams, laps or welds to break in service.
A chain is no stronger than its weakest link. The Sturdee Solid Shank Spoon has no weak spots. Its strength is matched and balanced. Every power, light, or communication company who has tried this spoon, now specifies it to the exclusion of any other type. To start a program that will save cost and increase efficiency, use Sturdee Solid Shank Spoons.
STURDETOOLS
a TRUE TEMPER PRODUCT
Western pattern, Sturdee Solid Shank Heavy Duty Spoon. Blade, shank and socket forged in one piece from a solid bar of steel. 13 gauge, heat treated blade. XX grade hickory or ash handle — lengths 6 feet to 12 feet.
Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

that General Electric used its patents to affect agreements with licensees which violate anti-trust laws.

•

Electrical Conductors Inspected by UL in '43

A total of 455,125 miles of electrical conductors was inspected at the factories and labeled by Underwriters' Laboratories in 1943.

According to figures just released by the label service department, this total is made up of: rubber-covered wire, 2,124,049,000 ft.; flexible cord, 183,433,000 ft.; fixture wire, 54,148,000 ft. and heater cord, 41,432,000 ft.

As compared with the totals for 1942, these figures represent an increase in the production of labeled rubber-covered wire and heater cord, and a decrease in the amount of labeled fixture wire and flexible cord.

•

Sylvania Enlarges Plant

Expansion of the Sylvania Electric Products plant at Brookville, Pa., has been approved by the Army Signal Corps. Addition of 13,500 sq.ft. will be provided for the manufacturing space and installation of a cafeteria. Now busy with production of sub-assemblies for radio and other electronic tubes, the Brookville plant will utilize sealing and exhaust equipment in the new section and complete the manufacturing processes. It is expected that a total of about 1,000 employees will be on the job when the new addition is completed and the plant is in full production.

•

Bars Aluminum Pay Rise

The War Labor Board has denied a general wage increase of 15 percent to 9,000 employees of the Aluminum Co. of America in plants at Massena, N. Y.; East St. Louis and Mobile, Ala., on the grounds that the workers had received all increases allowable under the "Little Steel" formula. Labor members of the board dissented.

•

Elliott Votes Preferred

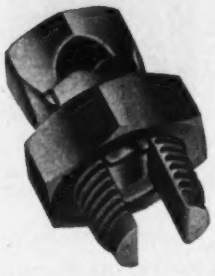
At the annual meeting of stockholders of the Elliott Co., held recently in Pittsburgh, an amendment to the company's charter was adopted authorizing the issuance of 77,252 shares of $50 par cumulative preferred stock. Acquisition of the Roto Co., Newark, N. J., manufacturers of tube cleaners, also was favorably acted upon.

Matthews Stazrite Guards

shown above and below have no hardware on them. They are attached to the guy wire at the top and to one of the bolts of a three-bolt clamp at the bottom. They become a part of the guy fixture and can not vibrate loose, turn over or be made a greater hazard by "one-arm drivers." The upper photograph shows the 14-gauge half round and the lower photograph shows the 16-gauge full round types. Send for Bulletin 301. Try them at our risk of your approval.

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.

RELIABLE Connectors



Save Time

by using solderless connectors with accurately fitting precision threads which insure easy, permanent installations.

Save Copper

by using these connectors which are good as new after being salvaged.

EASY TO INSTALL
LOW IN COST

Reliable
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES

Field Reports on Business

Plans already formulated for new construction indicate a strong post-war market in electrical equipment. Extensive rural line construction by private utilities and co-operatives in the near future is anticipated. At the present time light and power line supplies are active; small motor sales are steady.

NEW ENGLAND

It is evident that a strong post-war market in electrical equipment and supplies is assured as a result of plans that have been formulated for new construction in this area after the war. New England Telephone will spend about $100,000,000 in post-war projects which include plant renovations, the placing of about 150,000 miles of wire and cable, and the erection of 100 new buildings. Southern New England Telephone Company plans a $23,000,000 expenditure in addition to $8,000,000 annually to meet growth of service under peace-time conditions.

Brown Company plans to spend approximately $10,000,000 for improvements to its plants. Gifford M'f'g. Company, Boston, has been awarded a DFC contract totaling $65,000 for additional equipment to be installed in its Waltham (Mass.) plant, and General Electric has been allocated $600,000 for equipment to be used in its Everett (Mass.) plant.

Bidding on equipment and supplies for the Navy is brisk. Light and power line supplies are attracting attention; friction tape in lots as high as $50,000 is featured. Connecticut firms have bid on a portion of a 200,000 electric lantern schedule offered by the Navy, and on about 12,000 electric coffee makers. Chromalox immersion heaters and heating elements are selling well. Small motor sales are steady in single lots. Line materials are being bought for shipyard distribution line extensions. Water and sewage works are included in a recent FWA allocation of $1,560,000 and will require electric regulating and control apparatus.

CHICAGO

Indication was given this week by Commonwealth Edison officials that electric power loads for war production in the Chicago area have reached a plateau which may be expected to hold fairly constant probably until at least the end of the European phase of the war. While the surplus electric generating capacity available in the four-company Chicago utility group appears to be fairly adequate, attempts are being made to secure WPB approval for the postponed 50,000 kw. addition to the Dixon station of Illinois Northern Utilities.

Loan allotments by REA in the amount of $700,000 have been made to 14 cooperatives in Minnesota, Iowa and Wisconsin. These are the most recent of several allotments in this area which are the forerunners of what is expected to be considerable rural line construction activity on the part of the co-ops and private utilities during the coming summer.

During last month additions to the industrial facilities of Chicago since June 1940, climbed past the billion-dollar level. New plants and other expansion contracts undertaken during March amounted to $14,123,750. Largest single project launched within the past month is a new fluorine refrigerant factory of the Kinetic Chemicals Co., East Chicago. Most of the ultimate capacity of 2,000,000 pounds monthly is earmarked for the Army and Navy. Special electrical wire and cable for aircraft are to be made here by a subsidiary of Kellogg Switchboard & Supply Co., Cordage, Inc., which has just moved to the Chicago area.

NEW YORK

In spite of some cancellations of Army and Navy contracts, expansion elsewhere is offsetting these cutbacks, and the demand for war products remains at a high level. With the war entering its most critical stage, programs for increasing consumers' goods production are limited for fear of using labor and materials needed for the war effort. These considerations determine the industrial pattern for the next two or three months at least, the National City Bank of New York says in its recent bulletin.

Civil engineering construction volume in continental U. S. totalled $33,963,000 last week. This volume was 15 percent higher than in the preceding week, but was 64 percent below the volume reported to *Engineering News-Record* for the corresponding 1943 week. Public construction for the week was 36 percent higher than a week ago and is responsible for the increased total, as private construction was 23 percent lower. Compared with a year ago, however, public construction was down 68 percent, and private was 34 percent lower. The week's construction brought 1944 volume to $484,085,000 for the fourteen weeks of the period, a decrease of 51 percent from the $994,271,000 reported in 1943.

Final pre-Easter retail trade in the Metropolitan area reached large proportions with dollar volume at a new high level, despite the snowstorm and the let-down in purchasing from the heavy "beat-the-tax" buying of the previous week.

PACIFIC COAST

Western prices are beginning to reflect OPA's recent approval for permissible increases in wood pole line material, such as pins, brackets and steps, and also on flexible steel conductors.

Congress has just authorized $13,710,000 for Pacific Coast personnel and training centers; $15,700,000 for increased hospital facilities, and $110,000,000 for aviation supporting facilities. Previous appropriations for Army and Navy construction projects with their considerable night lighting installations are a sizable factor in Pacific Coast electrical business.

Approaching seasonable weather conditions for pole line construction are reflected in a $57,231 award for 33 miles in Colorado and a bid request for 16 miles of 115 kv single wood pole circuit of 3/0 aluminum cable for Colorado Big Thompson project. Light rainfall and rapidly decreasing snow level forecast a big seasonal business in pumping motors and medium transformers.

Orders include 750 distribution transformers, sizes 5 to 75 kw. costing $105,000; a refrigeration equipment consisting of 2 generator sets and 7 assorted 75 and 100 horsepower motors; $10,000 of fractional horsepower motors for oil burner outfits, and $17,500 of varnished cambric and lead-covered cable for Hunters Point drydocks.

Sales Opportunities

CALIFORNIA — Navy Department, Washington, D. C., has authorized expansion in power plant at naval air station, with installation of equipment for increased capacity in steam division, including new boiler units and accessories. Cost estimated about $750,000. C. C. Moore & Co., Inc., 555 South Flower St., Los Angeles, is consulting engineer. Project will be carried out under direction of Commanding Officer, 11th Naval District, Public Works Office, foot of Broadway, San Diego.

PENNSYLVANIA — Scotia Mining Co., Scotia, care of H. M. Wallace, Sunbury, president, plans new iron ore-processing mill at mining properties, where company will resume operations at a plant idle for a number of years. It will comprise several one and multi-story units, with machinery and electrical equipment for large output. New mill will be electrically operated, with power substation to be located at plant site and new transmission line constructed for power supply. It is understood that service will be furnished by West Penn Power Co., with transmission lines in that area. Machinery also will be installed for mining operations. Entire project is estimated to cost about $500,000, with financing by Defense Plant Corp. Leo Moerschbacher, Port Matilda (Centre County) is manager of company and will be active in development.

TEXAS—Navy Department, Washington, D. C., plans new airfield and will convert an existing blimp base for this purpose, including new buildings, with electrical and mechanical equipment. Also other electrical facilities and distribution lines. Entire project will cost about $2,000,000. Commanding Officer, Hitchcock, will supervise work. Lockwood & Andrews, Union National Bank Building, Houston, are consulting engineers.

OHIO—Cleveland Electric Illuminating Co., Cleveland, plans addition to Avon power plant, to be used for general service, including machine shop, storage department, locker room, etc. Cost estimated about $150,000, with equipment. Application has been made for permission to carry out work.

VIRGINIA — United States Rubber Co., 1230 Sixth Ave., New York, N. Y., has contracted with government for construction and operation of new mill on tract of about 100 acres of land for manufacture of rayon cord for use in automobile tire production. It will consist of three main one and multi-story units, with machinery and electrical equipment for large output. Also, power substation and several auxiliary structures for storage and distribution. Entire project is estimated to cost about $1,000,000. Financing by Defense Plant Corp. Work is scheduled to begin at once.

VIRGINIA—U. S. District Engineer Office, Fort Norfolk, Norfolk, has plans maturing for installation of a lighting system at airfield, and bids are scheduled to be asked at early date.

CALIFORNIA — Navy Department, Washington, D. C., has authorized expansion in marine corps air station, including shops, warehouses and other industrial buildings, with mechanical and electrical equipment. Also, new barracks, mess halls and miscellaneous structures, with extensions in power substation facilities and electrical distribution lines. Cost estimated about $800,000. Bids will be asked soon by Commanding Officer, 11th Naval District, Public Works Office, foot of Broadway, San Diego. Adrian Wilson, Architects' Bldg., Los Angeles, is architect.

MISSOURI—Pratt & Whitney Aircraft Co. of Missouri, Inc., Kansas City, will carry out expansion in local plant for production for government, including additional buildings with machinery and electrical equipment. Cost estimated about $700,000, with financing by Defense Plant Corp. Work will begin soon.

MICHIGAN—Water Department, Negaunee, has plans maturing and will ask bids soon for electrification of waterworks station, to include installation of four new centrifugal pumping units, with motors, controls and accessories, having ratings of 2,000, 900, 700 and 500 gal. per min., respectively. Application has been made for a priority rating. Greeley & Hansen, 6 North Michigan Ave., Chicago, Ill., are consulting engineers.

CONNECTICUT—Naugatuck Chemical Division, United States Rubber Co., Naugatuck, plans expansion in plant for production of synthetic rubber latex, a new line of output for company, comprising several new buildings, with machinery and electrical equipment. Cost reported over $1,200,000. Project will have a priority rating and is estimated to require about a year for completion.

CALIFORNIA—War Department, Washington, D. C., has authorized new postal concentration center at army base, consisting of a main building, 400 x 800 ft., and auxiliary structures, with mechanical and electrical equipment and facilities. Cost estimated about $1,000,000. Project will be supervised by U. S. District Engineer Office, San Francisco.

NORTH CAROLINA—City Council, Burlington, has plans maturing for extensions and improvements in municipal airport, including additional buildings with electrical and mechanical equipment, electrical distribution lines, etc. Bids will be asked soon. Cost estimated about $475,000. Project will be supervised by Civil Aeronautics Administration, Washington, D. C.

NEBRASKA—City Council, Sidney, has called special election, April 18, to approve purchase of electrical distribution lines and property of Consumers Public Power District in city area and north to point near Bridgeport, to be operated as municipal property in future. Also for approval of bond issue of $740,000 for project, including proposed extensions and improvements.

MINNESOTA—City Electric Department, Worthington, has plans nearing completion for extensions and improvements in municipal power plant, to include installation of new boiler unit and auxiliary equipment. Cost estimated about $200,000. It is understood that application will be made soon for a priority rating. Ralph D. Thomas & Associates, 1200 Second Ave., South Minneapolis, are consulting engineers.

WASHINGTON—Bonneville Power Administration, Portland, Ore., plans extensions in transmission lines in Clark County. A 50-year franchise is being arranged with Board of Clark County Commissioners.

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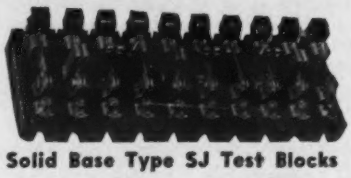

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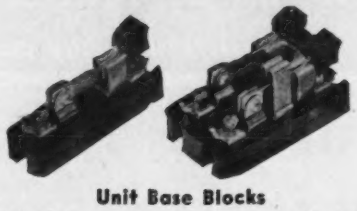

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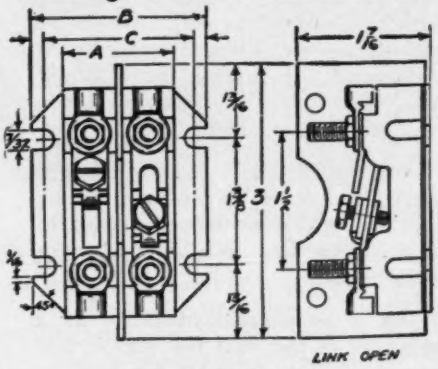

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And that isn't all. Even when your name does come up we shall not be able to supply the missed copies to fill out your file. We have no more extra copies.

This is an unusual situation for a publisher to face but the fact is that paper is extremely short due both to an increased demand for packaging of war materials for shipment overseas and to a shortage of labor in the woods. Supply of wood products of which paper is one of the most important is in the same critical position that copper products were in a year ago.

Like all other publications, we are operating under a fixed allotment of paper, having had two cuts. We did not cut the editorial content nor reduce the number of subscribers. What we did was to freeze our circulation at the current figure and then, as waiting lines of new subscribers began to grow, we adopted the policy of cutting off subscriptions promptly on expiration—not, however, without giving each subscriber at least four notices of expiration in time for him to send in his renewal.

We would much rather serve an old subscriber than a new one if it were a matter of choice. We don't, however, feel that a new subscriber should be denied copies while we are waiting for someone to make up his mind.

We will do everything within our power to serve you without a break if you will help us. Please answer renewal notices promptly.

Electrical World
330 W. 42nd STREET, NEW YORK, N. Y.

REA Allots Fund for Rural Projects

The Rural Electrification Administration announced recently allotments of funds totaling $1,140,000 to 25 rural systems in 12 states. The funds, which will be used for the most part to extend service to farms which can contribute substantially to the food production program, bring REA allotments to $482,413,551, of which $16,450,638 represents operations during the current fiscal year. No construction will be undertaken which does not have the prior approval of the War Production Board.

Included are the following allotments:

Illinois—Western Illinois Electric Co-operative, Carthage, $10,000.

Indiana—Harrison County REMC, Corydon, $20,000.

Iowa—Eastern Iowa Light and Power Co-operative, Davenport, $75,000; Nishnabotna Valley Rural Electric Co-operative, Harlan, $50,000; Franklin Rural Electric Co-operative, Hampton, $40,000; Pocahontas County Rural Electric Co-operative, Pocahontas, $35,000; Cherokee County Rural Electric Co-operative, Cherokee, $50,000; Osceola Electric Co-operative, Inc., Sibley, $50,000.

Louisiana — Washington-St. Tammany Electric Co-operative, Inc., Franklinton, $50,000.

Minnesota—Co-operative Light and Power Association of Lake County, Two Harbors, $10,000; Steele Waseca Co-operative Electric, Owatonna, $75,000; Crow Wing Co-operative Power & Light Company, Brainerd, $20,000; Red River Valley Co-operative Power Association, Halstad, $50,000; Todd-Wadena Power & Light Co-operative Association, Wadena, $80,000.

Missouri—West Central Electric Co-operative, Inc., Higginsville, $20,000.

Nebraska—Cedar-Knox County Rural Public Power District, Hartington, $30,000.

North Carolina—Randolph Electric Membership Corp., Asheboro, $25,000.

Oklahoma—Northfork Electric Co-operative, Inc., Sayre, $140,000; Rural Electric Co-operative, Inc., Lindsay, $60,000.

South Carolina—Horry Electric Co-operative, Inc., Conway, $25,000.

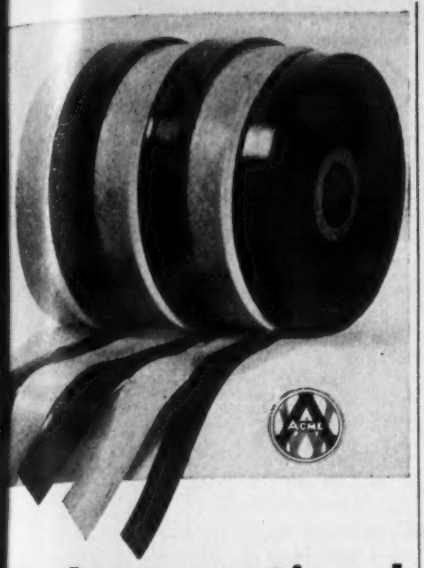
Texas—Bailey County Electric Co-operative Association, Muleshoe, $30,000; Hall County Electric Co-operative, Inc., Memphis, $30,000.

Wisconsin—Grant Electric Co-operative, Lancaster, $50,000; Lafayette Electric Co-operative. Darlington, $50,000; Waushara County Electric Co-operative, Inc., Wautoma, $65,000.

•

River Rise Delays Work on Kentucky Dam

The huge cofferdam at Kentucky Dam was flooded recently because of high water, and construction at the TVA project will be reduced to half-speed until the river lowers enough to allow the cofferdam to be pumped dry, Project Manager George P. Jessup stated. Main work discontinued will be



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the concrete construction under way inside the cofferdam. Machine work and activity on higher levels will be continued, Mr. Jessup said.

The cofferdam had to be flooded when the Tennessee River threatened to rise above the top of the structure.

•

Frequency Changes Made by Bureau

Two changes were recently inaugurated in the National Bureau of Standards standard frequency broadcast service. One was the addition of a new radio frequency, 2,500 kilocycles per second, at night; the other, the omission of the pulse on the 59th second of every minute. The service, which is continuous at all times day and night from 10-kw. transmitters, now includes: (1) standard radio frequencies, (2) standard time intervals accurately synchronized with basic time signals, (3) standard audio frequencies, (4) standard musical pitch, 440 cycles per second, corresponding to A above middle C.

At least three radio carrier frequencies are on the air at all times, to insure reliable coverage of the United States and other parts of the world. The radio frequencies are: 2.5 megacycles per second, 7:00 p.m. to 9:00 a.m. EWT.; 5 megacycles per second, continuously day and night; 10 megacycles per second, continuously day and night; 15 megacycles per second, 7:00 a.m. to 7:00 p.m. EWT.

The two audio frequencies are interrupted precisely on the hour and each 5 minutes thereafter; after an interval of precisely one minute they are resumed.

The beginnings of the periods when the audio frequencies are off are so synchronized with the basic time service of the U. S. Naval Observatory that they mark accurately the hour and the successive 5-minute periods.

Information on how to receive and utilize the service is given in Letter Circular LC731, "Methods of Using Standard Frequencies Broadcast by Radio" obtainable on request, National Bureau of Standards, Washington 25, D. C.

•

Expropriate Utility

A decision last week by the city council of Cali, Colombia, South America, to expropriate the Compania Colombiana de Electricidad terminated a paralyzing general strike in that city called in a demand for lower rates. The expropriation price, which was not disclosed, will be raised by a bond issue, it will be announced. The power company is an Electric Bond & Share Co. subsidiary, serving Colombia's fourth largest city.

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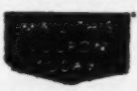

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Recent Rate Rulings

PORTLAND GENERAL ELECTRIC Co.'s application for rehearing of its case to restrain Public Utilities Commissioner George H. Flagg from enforcing an order reducing the electric company's rates approximately 10 percent has been denied by Circuit Judge George R. Duncan. The original order, in which Judge Duncan upheld Commissioner Flagg's reductive directive, was handed down several weeks ago. Following release of the original order the electric company filed the motion for a rehearing. Portland General Electric will appeal to the Oregon Supreme Court for a permanent injunction.

SPRINGFIELD GAS & ELECTRIC Co.'s new rate schedule, effecting an annual reduction of $304,000 for its electric customers. (ELECTRICAL WORLD, April 1, page 128), is temporary and will be used until the Missouri Public Service Commission, which ordered the reduction, completes its rate reduction against the utility. The new schedules are to be filed on April 15. The commission stated that the evidence before it indicated the company now is and has been for the past several years earning in excess of a fair return on its investments.

POTOMAC ELECTRIC POWER Co. hearing on the rates and charges for electric power furnished to the Braddock Light & Power Co., Inc., its affiliate, which serves customers in Arlington County, Va., the Pentagon Building, and the Navy Annex Buildings on Columbia Pike, has been set by the Federal Power Commission for April 18. The hearing was set as a part of the investigation instituted by the commission last July and the order just issued states that the investigation since conducted by the commission's staff discloses conditions, facts and circumstances which warrant a public hearing. The date of the hearing was set after consultation with the chairman and other representatives of the Public Utilities Commission of the District of Columbia.

OPA recently urged the Utah Supreme Court to sustain the state Public Service Commission's order for a $1,500,000 yearly reduction in rates of the Utah Power & Light Co. as an aid in the anti-inflation program. In a brief which OPA was allowed to file as amicus curiae, the federal agency asserted that "in view of the dangers and evils of inflation, the responsibility is so heavy and the need to 'hold the line' so vital for the nation's security that every price increase foregone and every price reduction made is a significant aid to battle on the 'home front'." In ordering the reduction, the commission held that original cost of the utility should be used in establishing a rate base and refused to accept evidence on reproduction cost of the company's property. The OPA brief declared that "to accept a reproduction cost valuation estimate made during war time obviously would lead to inflation." It also said that "original cost is the one sure anchor against inflation."

HASTINGS, NEB., municipal electric plant will put into effect on May 1 new rates which will save its customers approximately $32,129. The new schedule will cut the annual industrial rates $11,957, based on 1943 consumption, and the commercial rates $10,056. The rate for the first 50-kw.-hr. to residential users was cut from 4.5 cents to four cents per kilowatt-hour, effecting a saving to consumers of $10,114.

CAZENOVIA ELECTRIC Co. has been granted by the New York Public Service Commission permission to revise electric rate schedules, effecting in savings approximately $3,500 annually to the company's consumers in the towns of Cazenovia, Fenner, Sullivan, Nelson and Lincoln, Madison County. The reduction became effective April 1.

•

Fort Peck-Utility Contract Approved

Federal Power Commission has announced its order approving interim rates and charges carried in a proposed contract effective from July 1, 1943 for a period not to extend beyond March 1, 1945, for the sale of electric energy produced at the Fort Peck project on the Missouri River in Montana to the Montana Power Co. The proposed contract was filed for FPC approval by the Commissioner of Reclamation, as provided in the Fort Peck Act. As a wartime negotiated contract, the rates and charges which it carries are not intended to apply to long-term contracts, the order stated, and added that schedules of long-term rates are at present being studied by the Bureau of Reclamation.

Under the proposed contract Montana Power Co. (a) will pay the United States for the electric energy generated by the Fort Peck project and received from the Bureau of Reclamation at the rate of two and one-half mills per kilowatt-hour and (b) will pay the United States at the rate of $30,000 per year for the use of government facilities for assuring continuity of service and regulation at two of the delivery points; provided, that this annual charge will be remitted to the extent that the charges for energy exceed $220,000 per year.

In order to make available to the company power needed in the war effort the bureau has been supplying Montana Power Co. with electric energy from the Fort Peck project since July 1, 1943.

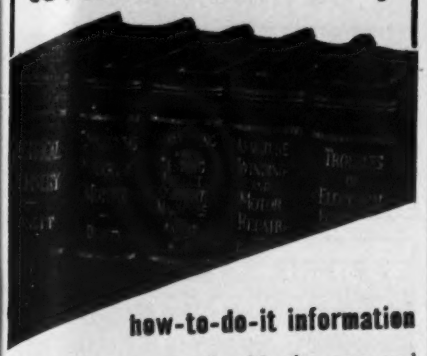
•

Commercial Laboratories Directory Issued

American Council of Commercial Laboratories has recently issued a directory of commercial laboratories to make available to business and governmental executives information about the scope of the activities of independent laboratories and of the services they render in the solution of scientific, engineering, testing and inspection problems.

Copies of the directory may be obtained from A. J. Nydick, executive secretary, American Council of Commercial Laboratories, 63 Wall Street, New York 5, N. Y.

Every phase of electrical maintenance and repair work covered in this library



how-to-do-it information

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

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LETTERS TO THE EDITOR

Uncontrolled Vision

To the Editor of ELECTRICAL WORLD:

You said it in your editorial "The Industry" in your March 4 issue.

The big boys have not put it over to the public. The cheapest commodity on the market is taken for granted and is not being appreciated for its value.

When the button pushers get over the idea that they, personally, are doing the great good, and realize that theirs is but a better opportunity for contributing to the common good, then will they be able to put out sincere public build-up material. You can't just assign 15 percent of the revenue to advertising and get someone to keep repeating your name to the public. We abhor monotony—we admire sincerity and innovation—and you were right by stating the need for "*uncontrolled* vision of youth."

A. F. MASTON,
Massena, N. Y.

•

Rate Base Working Capital Idea Not New

To the Editor of ELECTRICAL WORLD:

Reference is made to the item on page 21 of the news issue of ELECTRICAL WORLD for March 11, 1944, entitled "New Idea for Rate Base Working Capital." I used a similar basis for working capital in the Peoples Light, Gas & Coke Co. case in Chicago in April, 1937, and this matter is explained in considerable detail in the Illinois Commerce Commission Order in re the Peoples Light, Gas & Coke Co. case 19 P.U.R. (N.S.) 177 at pages 240-242.

Of course, I have no interest in the matter except to call it to your attention for the sake of accuracy.

WILLIAM A. DITTMER, Power Manager,
Bonneville Power Administration,
Portland 8, Ore.

•

Hydro Plans Rural Lines

Three hundred miles of rural lines will be constructed by the Ontario Hydro-Electric Power Commission next summer if the problems of labor and materials do not interfere with the plan, Chairman George Challies announced recently. Chairman Challies said the program would be divided among all parts of the Province on the basis of need.

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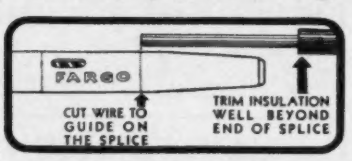

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BOOKS RECEIVED

The Power Industry and the Public Interest. Published by the Twentieth Century Fund, New York, N. Y. 261 pages. Price $2.

Balanced as to composition (both public or private ownership schools), the Power Committee makes certain specific recommendations based on this survey initiated in 1938. History of regulation is traced and its achievements appraised, the weaknesses being attributed largely to understaffed commissions. The old Supreme Court does not escape criticism for its effort to dodge responsibility through many years of adherence to the vague Smythe vs. Ames formula. Conclusion is reached that, as a whole, municipal systems receive no net subsidy but do yield an adequate return on investment. Subsidization of rural electrification is not decried. TVA should, this condensed report says, be able to liquidate all direct, reasonably allocated and imputed power costs under the established wholesale rates; no subsidy is detected in the set-up. No convincing evidence is found to prove that public works projects have induced investors to steer clear of electric utilities. "Necessity for regulation does not disappear with public operation" is another assertion.

Bonbright is the sole dissenter from the committee's otherwise unanimous recommendations. These embrace open negotiation of rates, wholesale generation regulated as an independent function, and regional regulation by joint federal-state boards. A strong plea is made that SEC come forth with a plain statement that ruination of holding company investors is not the intent in executing the so-called death sentence.

Pending issuance of the unabbreviated report, this condensation is an authentic portrayal of the history of electric utility regulation and what is still to be done in the name of equity and justice to all parties concerned.

Water Power Engineering—3rd Edition. By H. K. Barrows. McGraw-Hill Book Co. 791 pages, illustrated. Price $6.00.

Originally framed as a textbook, the 1934 edition, now extensively revised, is fully as useful to the practicing and operating engineer as to a student. Comprehensive design and experience data interspersed throughout the chapters give it the reference value of a handbook, worldwide in scope. Treatment ranges from the hydrology of an area to the electrical facilities and the requisite take-away transmission lines. Intervening sections deal with estimation of prospective development from stream-flow data, turbine characteristics, project layouts, dams and penstocks, plant powerhouse auxiliaries, gates, governors. Final chapters go into the economics of hydro vs. steam power with much identified cost data. A large table gives engineering details of 81 large hydros up to 1942.

Graphical Solutions. By Charles O. Mackey. Published by John Wiley & Sons. 152 pages, illustrated. Price $2.50.

Edition of 1936 revised to expand treatment of alignment chart construction and of projective transformation to achieve convenient proportions. Cornell's Professor Mackey has also added a discussion of the technique of tailoring an empirical equation to periodic curves as well as the former non-periodic.

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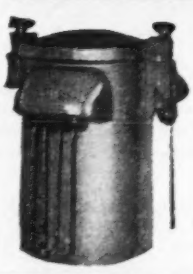

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	HP	Make	Type	Volts	Speed
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1—	800	G.E.	MPC	660	600
1—	625	G.E.	MPC	500	130
1—	600	G.E.	MPC	600	650/900
1—	500	G.E.	MPC	230	900
1—	300	G.E.	DMC	230	400/600
1—	300	G.E.	MPC	230	275/550
1—	300	Whse.		550	250/400
1—	270	G.E.	C	230	375
1—	250	Al. Ch.		230	525
1—	250	Whse.		230	400
1—	200	Whse.	SK	250	150/525
1—	175	G.E.	RC-19A	230	800/1600
1—	150	G.E.	MPC	230	250/450
1—	150	G.E.	MPC	230	250/450
1—	150	G.E.	CMC-65H	550	1200
1—	130	Cr. Wh.	CO-1832	230	625
1—	125	G.E.	SK-180	230	720
1—	120	Whse.	LC-50	230	1200
1—	100	G.E.	MPC	230	225/450
1—	100	G.E.	RC-19	230	575/720
1—	75	G.E.	LC	230	500/1000
1—	75	Whse.	SK-183	230	560/1100
1—	60	El. Dy.	258	230	525/1050
1—	50/60	Cr. Wh.	65H	230	500/1000
1—	50	Cr. Wh.	CMC-81H	230	300/900
1—	50	G.E.	RF-16	230	400/1600

TRANSFORMERS

	KVA	Make	PH Type	Voltages
6—	1667	Pitts	1 OISC	13200x2300
1—	1050	G.E.	2 WCTH	11000x445
1—	600	G.E.	3 HT-OISC	11550x2200
1—	333	Moloney	1 C-OISC	22000/11000x2300/575
1—	333	Whse.	1 OISC	2300x460
1—	333	Pitts.	1 OISC	2400x2x0
1—	300	G.E.	1 H-RP	13200x575/1150/2300
1—	300	Pitts.	3 ODSC	4150x208/120
1—	300	Packard	1 OISC	2200x220/440
1—	200	G.E.	1 H-LDD	26400x115/460
1—	200	G.E.	1 H-OISC	2300x115/230

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1—1500 KW GE 275 V. Gen. d.c. to 2100 HP, 2300 V. Syn. Motor.
1—1500 KW Whse 250 v DC to 2100 HP 4400/2200 v.
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1—350 KW G. E. 220 v AC Gen. d.c. to 500 HP 350 v DC motor.
1—100 KW Whse. SK 250 V. Gen. to 150 HP Syn. 2300 V. 900 RPM motor with excit.
1—75 KW G. E. 125 V. Gen. to 120 HP IK 4000/2300 V. motor.

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	KW	Make	Speed	D.C. Volt	Trans. Volts
1—	1500	Whse.	720	600	2300
1—	1500	Whse.	600	600	11500
1—	1250	G.E.	720	250	2300
1—	1000	G.E.	900	600	13200
1—	1000	Whse.	600	250	22000
1—	1000	Whse.	900	600	11000
1—	750	G.E.	1200	600	2300
1—	750	Whse.	720	250	6600/2300
1—	500	Whse.	1200	600	13200/2300
1—	375	G.E.	1200	250	6600/2300
2—	300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and D Ccontrols.

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3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	225	G.E.	ATI	240	600
1—	150	Al. Ch.		2300	900
1—	125	G.E.	ATI	220/440	900
2—	100	Whse.	G	2200	1800
1—	75	G.E.	TS-7556	220/440	600

Slip Ring

1—	1200	Cr-Wh.	801-Q	2200	237
1—	800	Whse.	CW	440	357
1—	800	Al. Ch.		440	885
2—	600	G.E.	IP	440/2200	720
1—	450	Whse.	CW	2200	875
1—	400	G.E.	IP	440/2200	600
1—	400	Al. Ch.		2300	505
1—	350	G.E.	IM	2300/4000	257
1—	300	Whse.	CW	440	585
1—	300	G.E.	IM	440	720
1—	250	G.E.	MT	4000/2300	257
2—	200	G.E.	IE-M	2200	1750
2—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	600

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1—	500	G.E.	1-178	2200	695
1—	400	Whse.	CS-1104A	2200	585
1—	350	G.E.	IK	440/2200	450
2—	300	G.E.	IK	440	350
1—	300	Whse.	CS	550	580
1—	300	G.E.	IK	2300	600
1—	125	Whse.	CS	220/550	1150
1—	125	G.E.	IK	220	720

SYNCHRONOUS CONDENSERS

1—	1000	G.E.	ATI	2200/3800	900
1—	750	G.E.	ATI	220/440	900
1—	600	G.E.	ATI	220/440	900

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1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—500 HP, 900 RPM, 440 volt, Lincoln slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E., sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2300 volt, G.E., vertical

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1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
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1— 50 HP, RPM, Westinghouse, type SK.

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3—150 KVA, G.E., 33,000 2300/4000 Y.
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3—100 KVA, G.E., 2200-220/110 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110
3—100 KVA, Allis-Chalmers, 2400/4150Y-2400
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1—750 KW, 250 volt, Allis-Chalmers, synchronous.
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1— 90 HP, 470/940 RPM, General Electric.
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1— 35 HP, 500/1500 RPM, Westinghouse.
1— 35 HP, 350/1050 RPM, Electric Dynamic.
1— 30 HP, 225/900 RPM, Crocker-Wheeler.
2— 25 HP, 300/900 RPM, Electro Dynamic.
1— 20 HP, 750/1500 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker-Wheeler.

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1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chalmers.
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600 KW, Terry dual bleeder condensing Turbine only.
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1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

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★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

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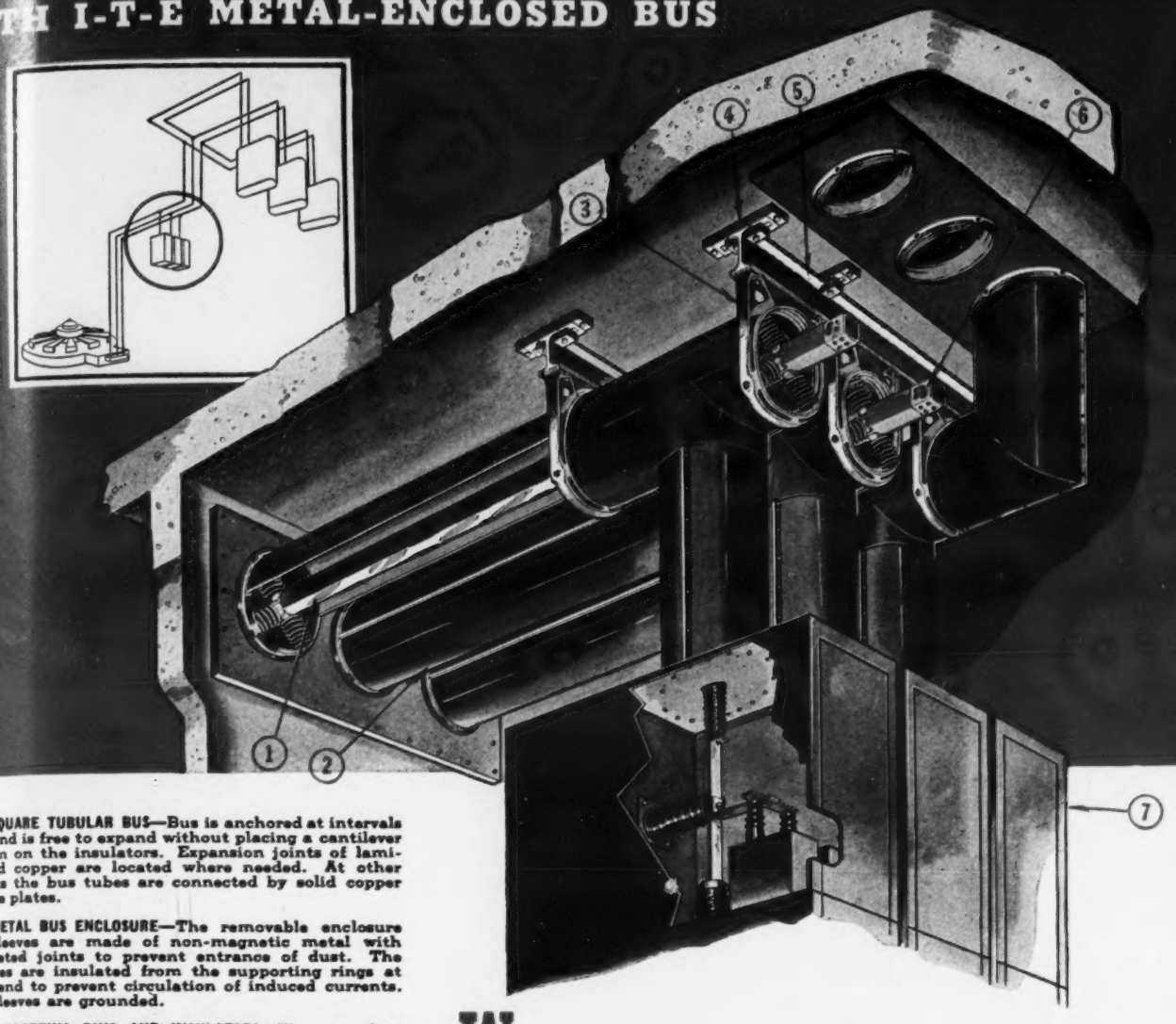

(1) **SQUARE TUBULAR BUS**—Bus is anchored at intervals and is free to expand without placing a cantilever strain on the insulators. Expansion joints of laminated copper are located where needed. At other joints the bus tubes are connected by solid copper splice plates.

(2) **METAL BUS ENCLOSURE**—The removable enclosure sleeves are made of non-magnetic metal with gasketed joints to prevent entrance of dust. The sleeves are insulated from the supporting rings at one end to prevent circulation of induced currents. All sleeves are grounded.

(3) **SUPPORTING RING AND INSULATORS**—The porcelain insulators are in compression and are free from cantilever strain because the bus can move longitudinally. Insulation is equal to that of connected apparatus. Each insulator is mounted in a ball and socket support to prevent any stresses except compression.

(4) **SUPPORTING BRACKET**—These brackets have slotted bolt holes in serrated bearing pads to allow accurate alignment of the bus during erection. Mounting bolts are grouted in the masonry. Installation is easy because of the accessible design of the whole structure.

(5) **GROUND BUS**—The ground bus is amply proportioned and bolted to the supporting brackets. The enclosing sleeves fit machined surfaces in the supporting rings when the sleeve clamping bolts are drawn up tight.

(6) **SILVER-SURFACED BUS JOINT**—All bus joints are silver-surfaced to give low voltage drop and permanent freedom from overheating. At elbows like this the buses are joined with laminated copper expansion connectors.

(7) **POTENTIAL TRANSFORMER COMPARTMENT**—The advantage of isolated-phase construction extends to these potential transformer compartments. Steel cells with dust-excluding gaskets give full protection. Short circuits cannot extend from phase to phase.

Whether conditions call for segregated-phase construction, as in the example illustrated, or a simple arrangement of conductors, electrical buses should be planned in the interest of life-long dependability and economy. With I-T-E such planning is an established business which starts with design and carries through complete assembly. I-T-E engineers have pioneered major improvements to provide structures that operate within specified temperature limits, are adequate electrically and mechanically and cause minimum voltage drop.

A detailed summary of the problems to be considered in planning is presented in a 24-page, illustrated booklet, "Electrical Buses and Bus Structures", written by William Deans, I-T-E Chief Engineer. It is Bulletin 4211, and a few copies are on hand.

A three-phase metal enclosed bus is shown because it is typical of thoroughly modern structures. The small diagram indicates position between generator and transformers.

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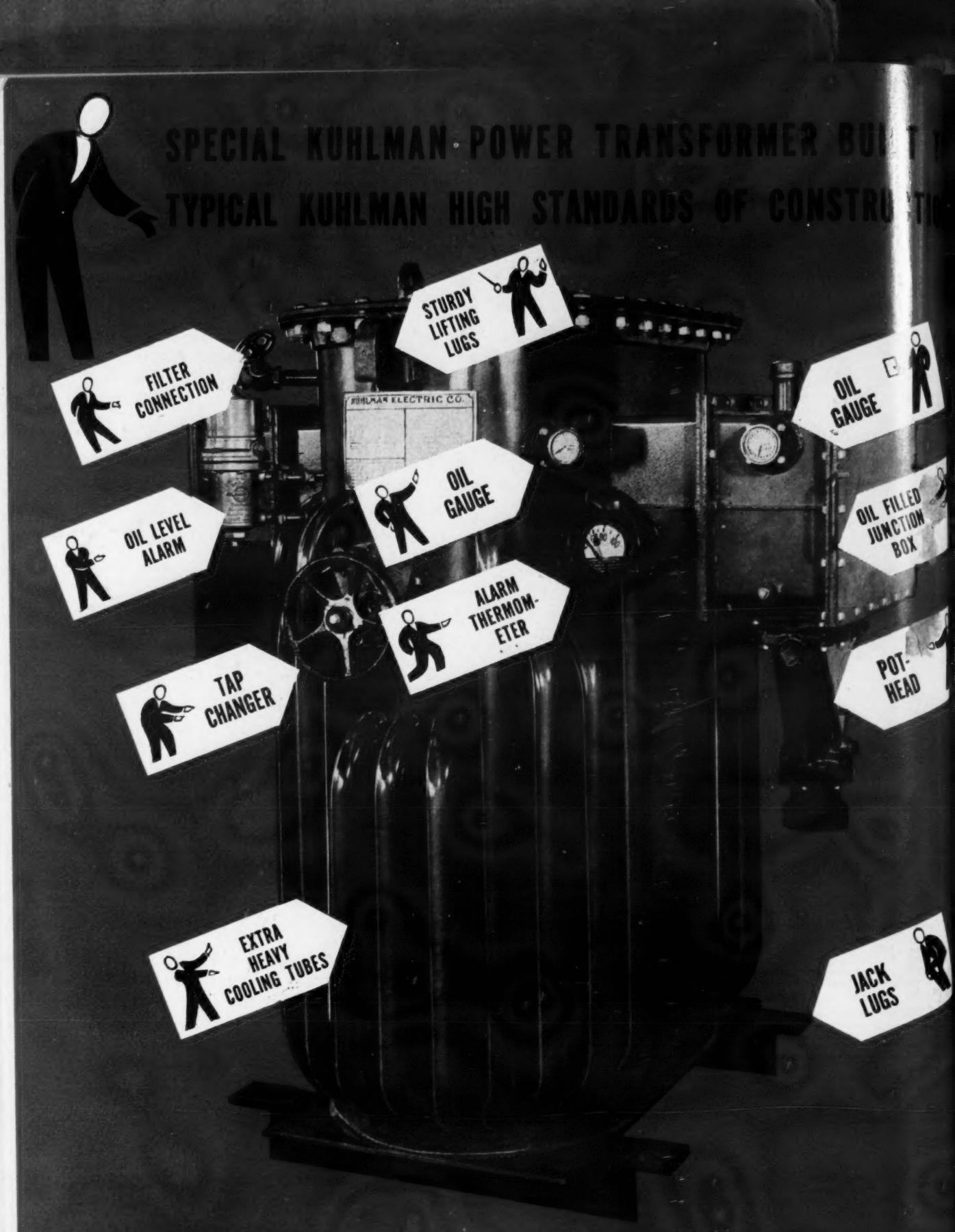

Whether its a special or a standard type of transformer, no detail is over-looked in the mechanical or electrical construction of Kuhlman Transformers. For facts about Kuhlman Power, C.S.P., Saf-T-Kuhl or Distribution Transformers or Line Regulators write to:

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